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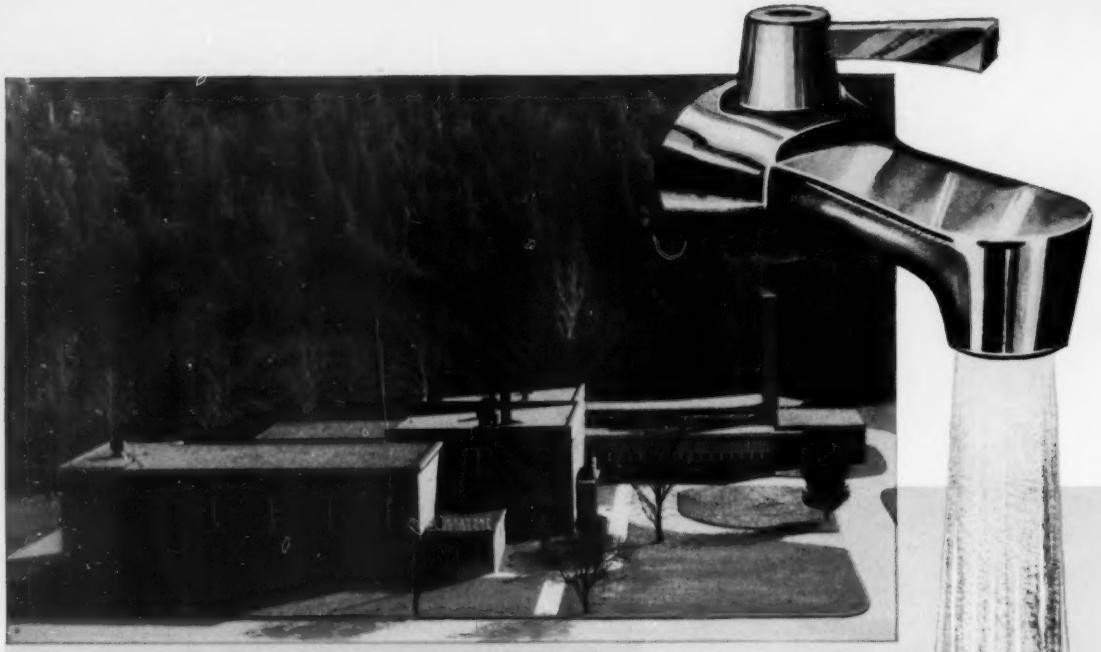

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Sample	WATER ANALYSIS REPORT (expressed in ppm) No. 1
Total Hardness	2200
Calcium	1580
Magnesium	620
Silica	15
Phosphate	.5
Iron	0
Phenol. Alkalinity	0
Total Alkalinity	160
Chloride	7
Total Dis'd. Solids	1350
pH	7.4

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THAT'S INTERESTING

Steamy seaway

Four mobile, 40-horsepower boilers manufactured by the Cleaver-Brooks Company, will be used in a unique application on the St. Lawrence Seaway. The units will be used to melt the ice accumulated on the lock stoplogs.

The boilers, mounted on hard rubber wheels for portability, will be pulled into position and will feed steam at the rate of 1200 pounds an hour to the unit heaters and to a steam gun which the operating crew can use to blanket the lock surface.

The resulting blanket of steam and warm air will thaw the ice collected on the gate's surface, freeing the gate for action.

During the summer, the boilers will be used for steam cleaning of the locks, gates, machinery and other equipment subjected to oil accumulation.

Closed-circuit TV under the sea

The Humphreys Salvage Company will be using a Diamond Underwater Television System during a six month program of exploration and salvage work in the Mediterranean Sea.

Capable of successful operation in 300 feet of water, the watertight stainless steel camera housing uses multiple "O" ring seals to prevent leakage. A ¾" thick Plexiglass window at the view end of the camera housing provides clear vision for the camera which is equipped with a vidicon type camera pickup tube.

In addition to the watertight camera, the system includes a camera power and control unit with provision for remote focusing of the camera optical system, and a viewing monitor. Both of these units are especially prepared to withstand the corrosive effects of salt air and spray.

May 30-June 5: Fifth World Petroleum Congress; New York

June 7-11: American Society of Heating and Air-Conditioning Engineers, Inc., Semi-Annual Meeting; Vancouver, B. C.

June 14-18: ASME Semi-Annual Meeting; Chase-Park and Plaza Hotels, St. Louis, Mo.

June 17-20: 1959 Engineering Progress Exposition; Hotel Commodore, New York, N. Y.

June 22-24: American Society of Refrigerating Engineers, Annual Meeting; Lake Placid Club, Lake Placid, N. Y.

Aug. 9-12: ASME-AICE Heat Transfer Conference; University of Connecticut, Storrs, Conn.

Aug. 18-21: Western Electronic Show and Convention; Cow Palace, San Francisco, Calif.

Sept. 20-25: 14th Annual Conference and Exhibit of the Instrument Society of America; Chicago, Ill.

Sept. 27-30: 1959 National Power Conference; Hotel Muehlebach, Kansas City, Mo.

Sept. 28-Oct. 1: American Welding Society, Fall Meeting; Sheraton-Cadillac Hotel, Detroit, Mich.

Oct. 6-9: Stanford Research Institute International Symposium; Asilomar, Monterey Peninsula, Calif.

Oct. 7-9: ASME-AIME Solid Fuels Conference; Cincinnati, Ohio

Oct. 12-14: 1959 National Electronics Conference; Hotel Sherman, Chicago, Ill.

Oct. 22-23: 15th Annual National Conference on Industrial Hydraulics; Hotel Sherman, Chicago, Ill.

Oct. 29-30: 1959 Electron Devices Meeting; Shoreham Hotel, Washington, D. C.

Nov. 2-5: 11th Exposition of Air-Conditioning and Refrigeration Industry; Convention Hall, Atlantic City, N. J.

Nov. 16-20: Fifth International Automation Congress and Exposition; New York Trade Show Building, New York, N. Y.

Nov. 29-Dec. 4: ASME Annual Meeting; Chalfonte-Haddon Hall, Atlantic City, N. J.

Dec. 8-10: Second National Conference on Application of Electrical Insulation; Shoreham Hotel, Washington, D. C.

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Specifically speaking...

Now, that warm weather has descended upon us (it hit us here in Chicago like the opening of a furnace door), there will be lots of talk for the next few months on air conditioning. Of course, plant and power services people who are responsible for the design and operation of air conditioning systems have more to talk about than just keeping cool — the efficient operation of their air conditioning plants.

One of the biggest problems facing air conditioning engineers is that of proper water treatment. John L. Thornley, chief chemist of The Bird-Archer Company, Philadelphia, has devised some clear-cut rules on proper water treatment for various types of air conditioning plants. He presents these in his article on page 13 . . . and summarizes them in a handy chart on page 14. By the way, if you're keen on air conditioning stories, you will want to read next month about Lambert-Hudnut's method of running an air conditioning machine on high-temperature hot water.

Dependable power sources is a subject that is of interest any time of the year. For dependable switchgear control, Rohm & Haas is using a long-life, 60-cell, lead-calcium plate battery at its Lennig, Pa., plant. By long life, we mean that the battery's life expectancy is estimated at 25 years. You'll find this interesting story on page 15.

Our cover story, this month, is on a subject that has fascinated man for centuries. It is only lately that he has decided to do something about it. This subject is the commercial production of fresh water from sea water. As plant and power services largely depend upon water in one way or another for its operation you will enjoy this up-to-the-minute report on sea water conversion by Fred A. Loebel president, Cleaver-Brooks Special Products. Mr. Loebel discusses the cost picture together with a rundown on the various processes in his article beginning on page 18.

Some unusual pilot hook-ups on regulator valves give Pilgrim State Hospital maximum flexibility in steam pressure control. This vast institution — almost a city in itself — uses steam at three different pressures for all heating, cooking, laundry, and hot water needs. These pilot hook-ups are explained, as well as pictured, in the story told by chief engineer, George Hoover, on page 22.

You'll also be interested in the numerous important stories appearing in the other parts of this issue. The "Reports in Brief" section describes the latest advances in thermoelectricity. The "New Solutions" section contains among others a story on coal car thawing with infra-red lamps. Some equipment items described in the "New Developments" section include double-acting air cylinders, aluminum lagging for boilers, and a boiler water recorder.

W. A. Countryman

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QUALIFIED READER SUBSCRIPTIONS are accepted without charge from selected executives and engineers who manage plant and power services in plants and organizations. Subscriptions are accepted from "non-qualified people" — i.e., those whose job responsibilities are not within the orbit of management as described above — at $1.00 the copy; $10.00 the year in U.S.; $15.00 outside U.S. Note: Such subscriptions are available only as an accommodation and in response to specific request. They are not counted as "industry circulation" on BPA Audit Reports. Accepted as controlled circulation publication at Mendota, Ill., 1501 W. Washington Rd.

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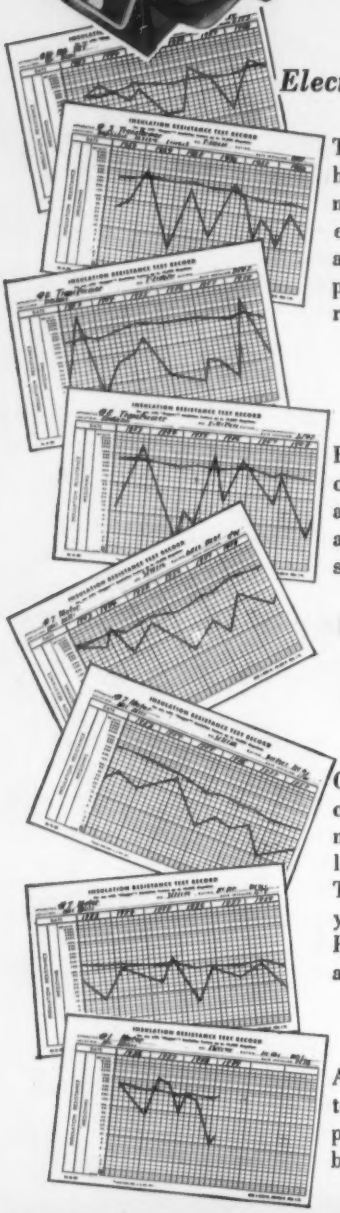

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Circle 9002 inside back cover.

REPORTS IN BRIEF

New thermoelectric material

A big forward step in the development of thermoelectric materials has been made by scientists at Westinghouse research laboratories.

They have developed a semiconductor material for use in the temperature range from 850° to 1500°F. This top temperature is well above the melting point of aluminum, magnesium and many common thermoelectric materials.

Development of the new three-element compound, known as indium arsenide phosphide, fills a gap in the substances which up to now have been available for thermoelectric power generation. It is expected to find immediate use in thermoelectric devices operating at temperatures well above those previously considered practical.

Many semiconductors, including those used for thermoelectric refrigeration and for power generation at temperatures of a few hundred degrees, lose their thermoelectric properties — or even decompose — at temperatures below those necessary for effective power-producing devices.

The new material brings scientists into the range of operating temperatures where the extremely high-temperature mixed-valence thermoelectric compounds can begin to take over.

More automation in electric utilities

Two big steps in further automation of generation and systems control have been announced by leading power companies.

At "Little Gypsy"

A new 225,000-kw facility, to be constructed at Little Gypsy, La., for Louisiana Power & Light Company, will be the first fully-automated electrical power generating station. All phases of this operation, from start-up through operation to shut-down, will be controlled automatically by a special electronic computer system designed and built by Daystrom Systems, La Jolla, California.

Between each of 800 different start-up or shut-down steps the computer will scan — at lightning speed — 700 different temperatures, pressures, flow rates, and valve and switch positions. If all is in order, the electrical command goes out to the hundreds of valves and switches to change to the next position.

The computer system will be of the "solid-state" type, using a total of 4000 transistors and more than 7000 diodes. For maximum operating life, it contains no moving parts.

Real advantage of the control system is said to result from faster reaction and greater sensitivity. Thus, the station can be operated much closer to actual equipment operating limits for highest overall efficiency and, most importantly, with unprecedented safety.

In addition to continuously monitoring all phases of the station's operation, the computer will examine itself every two minutes. If it finds itself "confused," it will "resign" and turn over the operation of the plant to the human operators.

At Philadelphia Electric

Philadelphia Electric Company and Minneapolis-Honeywell have announced a joint program to develop and operate an advanced automatic control system, "masterminded" by a digital com-

puter. First in the electric power industry, the system is scheduled to be placed in operation by Philadelphia Electric by the end of 1960.

The transistorized high-speed computer will use digital techniques to calculate the least expensive pattern of allocating generation to meet system demands. It will then automatically assign this allocation to generating units. As a secondary function, while "masterminding" the power network, the unit will provide cost data for billing computation on the power exchanged with neighboring electric companies.

The computer will call upon information stored in its "memory" on such factors as transmission line losses and production costs for each generator in the Philadelphia Electric system. Simultaneously, it will "read" data constantly being fed into it by control instruments and make use of other data in making control computations.

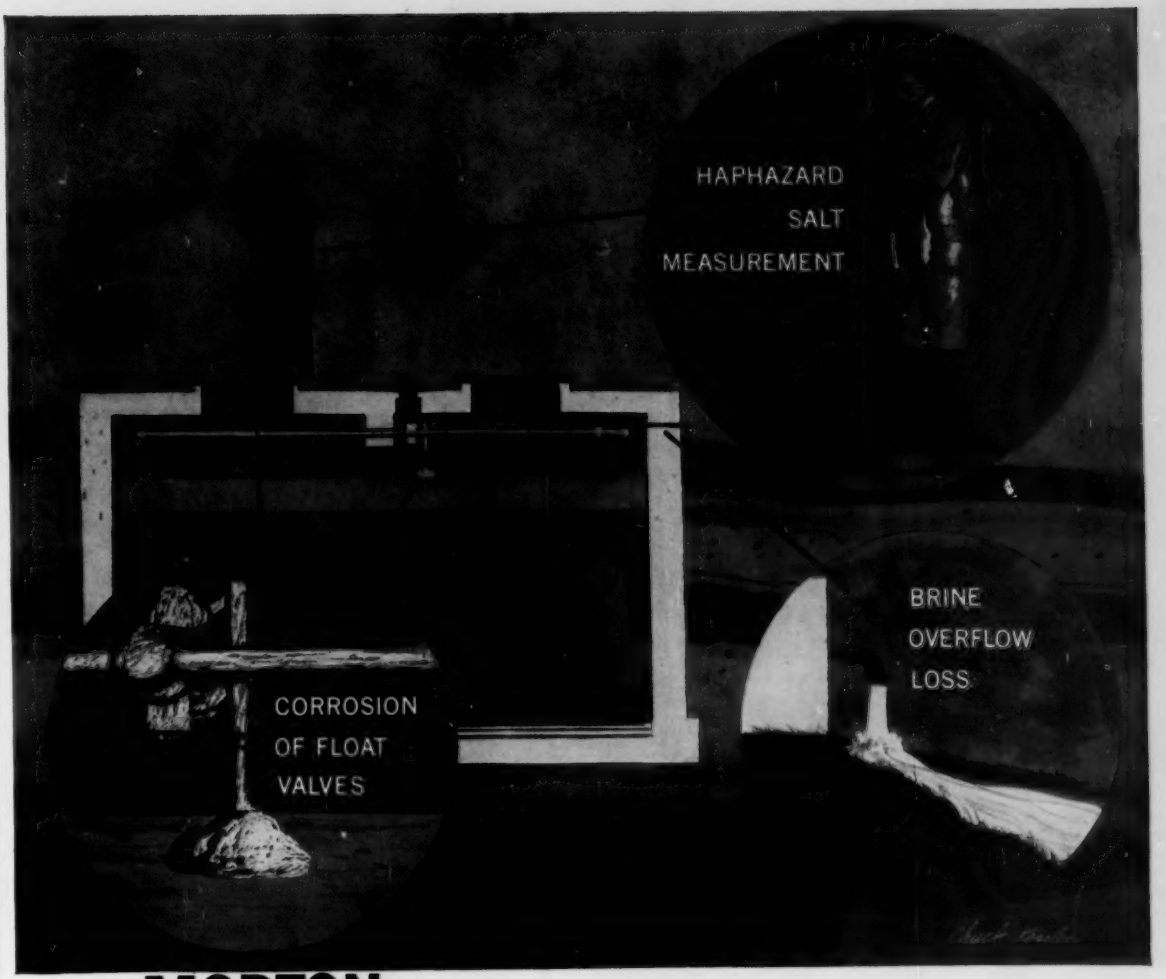
Using equations, the computer then will mathematically determine, in millionths of a second, how much generation is to be produced by each generating unit under automatic control.

Vallecitos BWR turbine not "hot"

The turbine for the General Electric — Pacific Gas & Electric Vallecitos BWR plant has not retained enough radioactivity to hamper normal maintenance procedures, according to a team of nuclear experts from General Electric.

The turbine has been in operation for over a year, over 3000 hours on the line.

It was also reported that no problem of corrosion product deposition was found in the heat transfer surfaces of the Vallecitos plant. The problem of oxygen in the reactor coolant of pressurized water reactors was solved by utilization of an excess of hydrogen.



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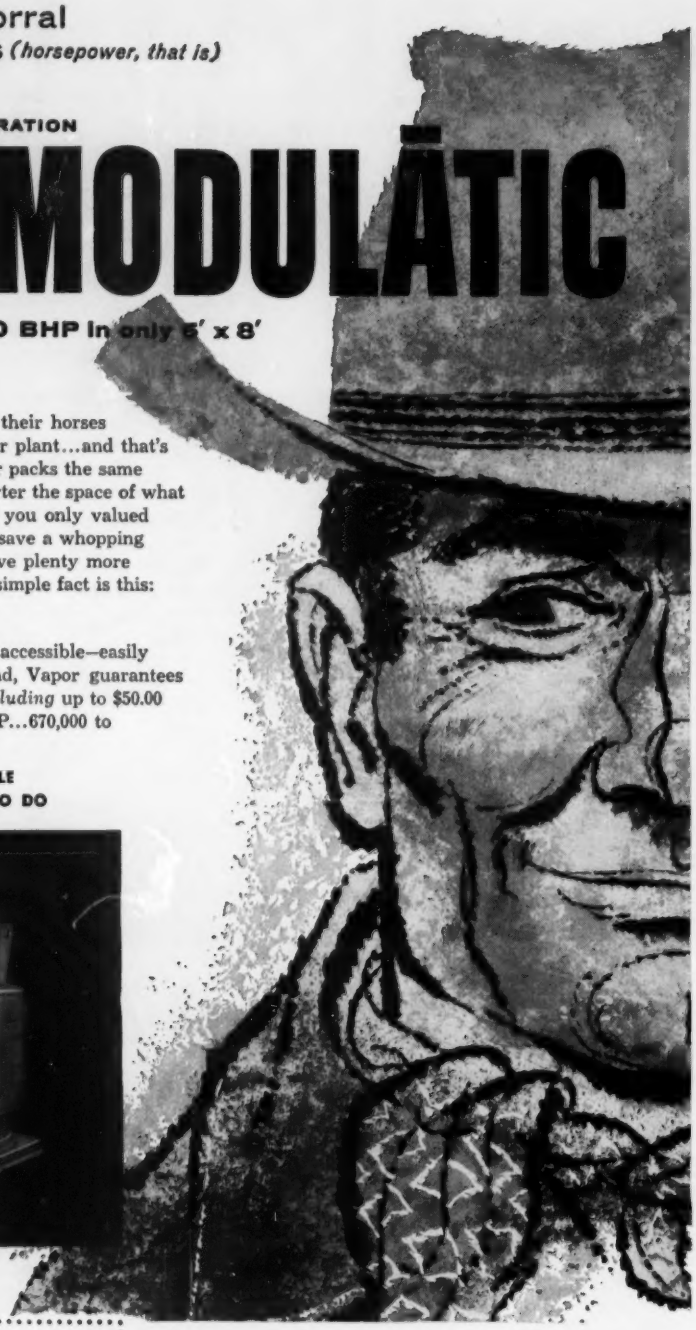

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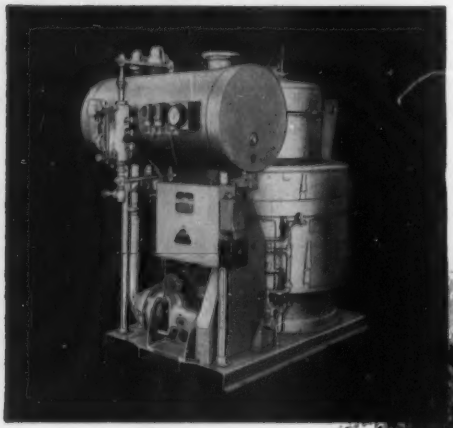

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Circle 9004 inside back cover.

REPORTS IN BRIEF

Fluorescent light goes square

An experimental square fluorescent lamp providing a new dimension for lighting of business and industry, as well as tomorrow's homes, has been unveiled by General Electric's Nela Park laboratories.

The lamp gives more light than the conventional 100-watt bulb and consumes half the electricity.

It is emphasized, however, that the new design is experimental and commercial introduction cannot be predicted at this time.

The lamp is made by sealing two channeled-plates of glass together to form a thin, nearly flat panel approximately one foot square and about one inch thick.

The thin design shows promise of reducing building costs, and less space will be needed in walls and ceilings to provide for the mounting of this type lighting equipment.

Lower-cost fresh water from the sea

Distillation plants using conventional fuels and linked with electric power generating units can now extract fresh water from the sea at less than 85 cents per 1000 gallons cost.

Using design and rating criteria now proved commercially successful, less than 85-cent sweet water is provided by plants of about 2,000,000 gallons per day capacity.

Modern flash distillation process has also been applied successfully to supply fresh water from the sea for numerous marine and stationary installations both in this country and abroad.

Further reductions in the cost of fresh water obtained from the sea are predicted because of continuing research and development.

(Sea to fresh water units are manufactured by The Griscom-Russell Company, Dept. P&PSE, Massillon, O.) Circle 9005 inside back cover.

Five-pound generator

The Nuclear Division of The Martin Company has been named winner of the 1958 Miniaturization award for its development of a five-pound atomic generator.

During its lifetime the unit will produce electricity equal to that furnished by nickel-cadmium batteries weighing almost 300 times as much.

It is the first device to combine a radioisotopic heat source with a highly efficient thermoelectric conversion system on anything more than a laboratory scale. As such, it opens complete new horizons in the field of compact power generation.

The Martin Company is already at work on a 100-watt generator using same basic principle but with strontium 90 as the radioisotopic fuel.

An advanced generator of this type, about the size of a kettle drum, could supply power for nearly a decade without refueling or servicing. It might find use in remote weather stations, navigation buoys, or aircraft lane warning beacons.

Leasing plan strictly for power

A special "Package Lease Plan" for the power industry has been made available by the Nationwide Leasing Company. Under this plan any combination of equipment may be considered one package and leased as a unit for three to five years.

The company has stated the plan permits large and small firms to acquire $10,000, $25,000, $50,000 or more in equipment without capital investment.

It was developed to meet the need of firms in the power field to expand and modernize production facilities without depleting their liquid working capital.

By writing to the Nationwide Leasing Company, 11 South LaSalle St., Chicago 3, Ill., you may obtain further information and a chart of the Package Lease Plan.

Flexible magnet

Development and production of a flexible magnet, with permanency claimed to be superior to most conventional magnets, was announced recently by B. F. Goodrich Industrial Products, a division of The B. F. Goodrich Company.

The new material is Koroseal vinyl plastic specially compounded and processed to react exactly like metal or ceramic magnets. It can be produced in continuous lengths in an unlimited number of shapes ranging in size from spaghetti to garden hose. It can be cut without impairing its magnetic qualities.

The plastic magnet is attracted to ferrous metals or to itself. Unlike the steel type, which can be magnetized only lengthwise, with the north pole at one end and the south at the other, the new flexible magnet can be magnetized in any direction.

About damping capacity

The shock absorber action that nature builds into metals is known as "damping capacity". It enables some metals to withstand the weakening effects of vibration. Lack of it, or low damping capacity, has been blamed for bridge failures and airplane crashes.

Resultant vibration fatigue can also be a source of trouble in missiles traveling at supersonic speeds.

The Bureau of Mines has been studying this phenomenum in metals for several years and, shortly before World War II, developed several new manganese-copper alloys with extremely high damping capacity for use in certain defense applications. Since the war, considerable progress has been made by the Bureau in finding ways to measure the damping capacities of various metals.

This progress and several unique instruments created by Bureau technologists to obtain precise measurements of damping qualities of metals are described in a new bureau publication written by J. W. Jensen, a physicist at the Bureau's Mississippi Research Center, Rolla, Mo.

Its title is "Report of Investigations 5441, 'Damping Capacity — Its Measurement and Significance'" and it can be obtained from the Bureau of Mines Publications Distribution Section, 4800 Forbes Ave., Pittsburgh 13, Pa. Persons requesting the publication should specify its number and title.

Reverse-flow treatment improves effluent

Lower electrolyte leakage, greater uniformity of effluent quality and reduced operating cost are provided by new cation regeneration method. Chief use of new method is to get the purest effluent possible from high solids waters.

Known as fixed-bed, reverse-flow regeneration, method consists basically of a means of flowing regenerant up instead of down while maintaining a fixed, rigid resin bed.

By pumping acid up through the bed, the band of resin richest in hydrogen is at the bottom which is the point the water being treated touches last before leaving the unit. This rich band becomes a scrubber zone and reduces "leakage" so that a purer effluent is produced.

Using conventional downward regeneration, improvement of effluent quality is accomplished by one of two expensive methods — increased acid dosage or increased bed depth.

Reverse flow regeneration, however, requires only the one added cost of specially engineered equipment installed in the top section of the cation unit. Operating results show this system has superior performance characteristics compared with the other two methods.

(Fixed-bed reverse flow system has been developed by Graver Water Conditioning Co., Dept. P&PSE, 216 West 14th St., New York 11, N. Y.) Circle 9006 inside back cover.

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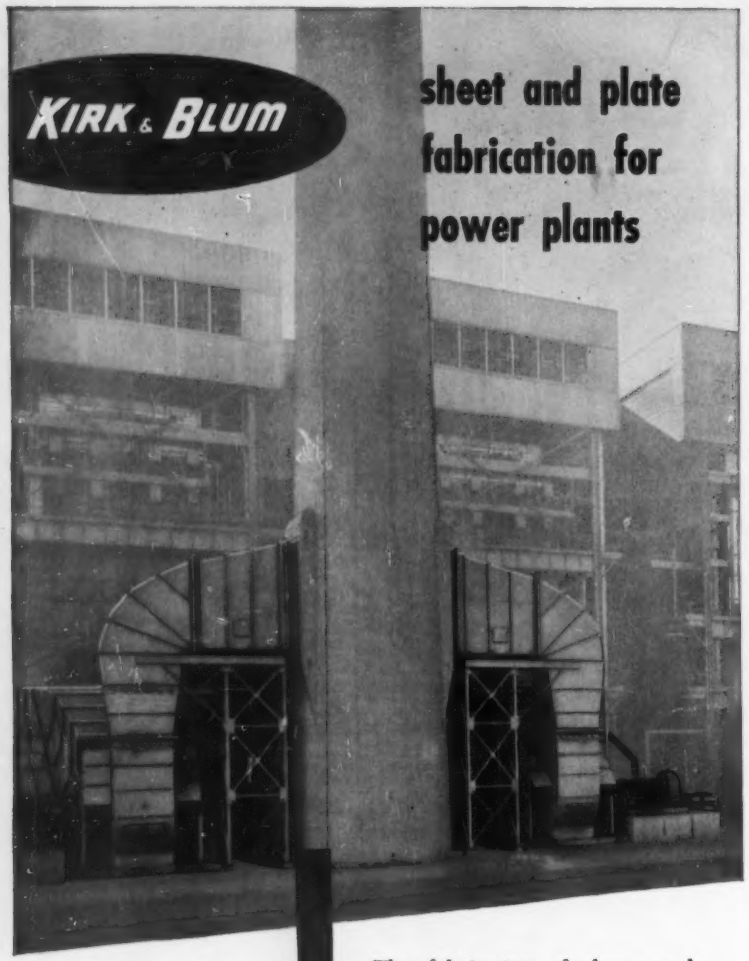

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REPORTS IN BRIEF

Research on nuclear boiler design

A basic research program aimed at improving the design and efficiency of nuclear boilers and other pressure vessels is underway at Southwest Research Institute.

The work is jointly sponsored by the AEC and the Pressure Vessel Research Committee of the Welding Research Council.

This study is aimed at reducing over-design in nuclear boilers.

Three lines of approach will include static analysis of the stress distribution around openings, changes due to initial cycling, and determination of plastic fatigue for a variety of nozzle configurations.

Plastic fatigue studies will be conducted at pressures up to 10,000 psi.

Largest gas turbine for peaking

The trend continues toward utility use of modern peak load equipment to reduce capital expenditures.

Largest combustion gas turbine-generator yet scheduled for installation in the United States has been ordered by the New Orleans Sewerage and Water Board from General Electric Company's gas turbine department. The unit, costing $2 million, is rated 20,200kw at standard conditions.

It will firm up base power and meet peak demands of the expanding utility system of the Sewerage and Water Board.

The gas turbine unit is adapted from a 16,500kw, simple-cycle, single-shaft machine of which nine have already been ordered or installed.

One of the largest capacity industrial load gears yet produced in the United States will connect the gas turbine to the generator and reduce the turbine speed of 3600 rpm to 750 rpm. The gear will be approximately 7½ feet long and have a width of 10 feet.

Gives longer life to rewound motors

A new solventless epoxy "thin-wall" encapsulation process is now being used by all Westinghouse Electric Corporation repair shops for extended operating life of rewound electrical motors.

Low viscosity of the epoxy provides superior penetration into the spaces between the windings and through the slots for completely void-free encapsulation.

Process can be furnished on Class A, B, or F rewinds with their respective maximum operating hot-spot temperatures of 105, 130 and 155°C. Since wall thickness is precisely predetermined, the insulation gives total protection with maximum internal heat transfer away from the windings.

Smooth glossy surface of completely inert material covers the windings. Process offers extreme resistance to the destructive effect of water, oils, acids, alkalies, dirt, conducting dusts, abrasives and other contaminants.

Material can be applied to the windings of random-wound motors and armatures as well as stators, for full motor protection. Because of its flexibility, it is not affected by differential expansion and contraction resulting from operating temperature fluctuations.

Package nuclear power for the Army

Design of a nuclear reactor plant capable of powering remote-area military installations has been in work for seven months by Alco Products, Inc.

Final development of a reactor core for the plant would be an addition to the Army package power reactor family of nuclear power facilities.

The plant concept would produce a minimum of 6000 kw. This output would give the station more than three times the output of the prototype designed and built by Alco at Fort Belvoir, Va. for the Army and the AEC.

ASSOCIATION NEWS

. . . reports of conventions, papers and people from associations of interest to plant and power services engineers

New lighting handbook is out

A completely new 1100-page Third Edition of the well-known "Lighting Handbook" has been published by the Illuminating Engineering Society.

This latest edition brings up-to-date the many and dynamic developments in lighting since 1952 when the Second Edition was published.

All sections have been completely restudied and revised by over 700 members of the society. New sections have been added in order to gather all pertinent information under specific subject headings. Many new illustrations, charts, graphs and tables are presented.

Of particular importance is the new table of higher recommended lighting levels for almost every conceivable lighting task. These levels are published in full for the first time anywhere.

Price is $10 per copy, and details may be obtained from Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, New York.

Heat exchangers to get new standards

The Technical Committee of the Fuel Oil and Water Heater Manufacturers Association is in the process of writing thermal and mechanical standards covering steam to water, water to water, and other types of shell and tube heat exchangers.

When these are complete they will be available in brochure form to engineers for specifying purposes from the association which is located at 50 East 42nd St., New York 17, New York.

Standardization would save $4 billion a year

The American economy could save at least $4 billion a year if all those who neglect standardization would now get wise to it . . . and as our economy moves into the space age, the waste is likely to increase.

This was the subject of a talk given by Cyril Ainsworth, Deputy Managing Director, American Standards Association, to a group of engineers in Kingsport, Tenn.

As to what is meant by standardization, Mr. Ainsworth pointed to knives, forks and spoons. The standard sizes and shapes of these utensils have been accepted all over the world, but the standardization was a slow process of elimination until the most acceptable shapes and sizes emerged.

This is also the case for boilers. It took close to 200 years to develop and agree upon a workable safety code for steam boilers. Before the code became available, boiler explosions were one of the most serious causes of loss of life and damage to property.

Today, the nuclear reactor presents the same story . . . and it's obvious that we can't wait almost 200 years for workable safety standards in this field. Even though individual reactors are constructed with all possible safety features, generally applicable safety standards are greatly needed.

Hotel lighting

A complete guide for proper hotel lighting has been published by Hotel Lighting Subcommittee of the Illuminating Engineering Society in collaboration with the American Hotel Association.

As well as dealing with lighting problems in guest and working areas, the 40-page booklet discusses types of bulbs and fluorescent tubes, use of color, maintenance and cleaning of lighting installations, and economics of good lighting.

Completely illustrated booklet, "Lighting for Hotels", may be obtained from Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N.Y. Single copies cost 70 cents.

Guide gets new size

The "Heating Ventilating Air Conditioning Guide 1959" has been enlarged to an 8½ by 11 inch page size to provide additional space for new technical data. This 37th edition contains larger illustrations, working charts and tables including 286 new or revised diagrams and charts.

Following the general format of previous editions, the 768-page technical data section is divided into 12 general sections: Fundamentals; Environment, Comfort, and Physiological Principles; Heating and Cooling Loads; Room Heating and Cooling Methods and Equipment; Air Systems and Equipment; Steam and Water Systems and Equipment; Heat Generating Methods and Equipment; Refrigeration, Spray Apparatus, and Sorbents; Controls, Instruments, and Motors; Specific Applications; Industrial Systems; General.

Five new chapters include: High Temperature Water Systems, The Heat Pump, Evaporative Air Cooling, Humidification, and Snow Melting.

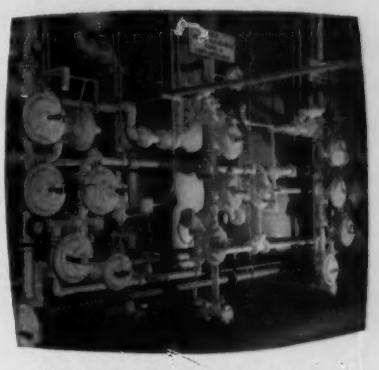
Catalog Data Section contains 461 pages showing products of 309 manufacturers with an equipment index broken down under numerous headings.

The Guide is published by American Society of Heating Refrigerating and Air-Conditioning Engineers, 62 Worth St., New York 13, N. Y. Price of single copy is $12.00.

THESE NEW IDEAS HAVE COME FROM

ILLCO-WAY DESIGNERS AND BUILDERS

MODERN EQUIPMENT FOR ionXchange



Illinois Water Treatment Co. was incorporated over 20 years ago to use the newly-discovered resins in the development of ionXchangers.

1942 By this time, IWT had already built more than 50 successful multi-bed ionXchangers (some of which are still in use today).

1943 IWT brought "automation" to ionXchange with the introduction of automatic ionXchangers, some of which were very large. (Some of *these* are still operating today, also.)

1947 This was also the year when IWT brought out the first large (400 gpm) ionXchanger for silica removal.

1949 IWT built the first commercial *Mixed Bed* ionXchanger.
(U.S. Patents 2605084 2771424)

1954 A huge 5,000 gpm fully-automatic mixed-bed ionXchanger was designed and built by IWT to remove silica from make-up water for high-pressure boilers. This plant has now de-ionized over SIX BILLION pounds of water.

1957 IWT introduced "Counterflow," the first really new idea in multi-bed ionXchangers since the introduction of silica-removal techniques. (Patent pending.)

THIS EXPERIENCE CAN MEAN A LOT TO YOU

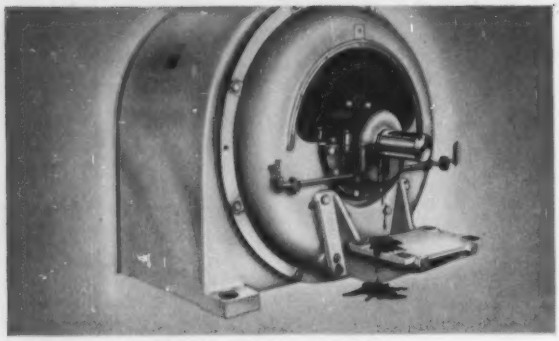
These ideas, and other IWT developments, can mean reduced costs, improved operations, and greater efficiency in your plant. *Check with your IWT representative.*

ILLINOIS WATER TREATMENT CO.
840 CEDAR ST., ROCKFORD, ILLINOIS
NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.

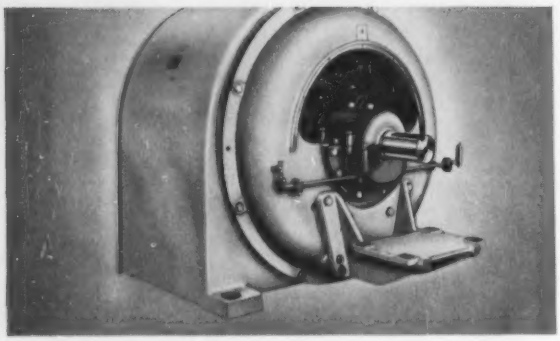
Circle 9009 inside back cover.

NON-FLUID OIL

TRADE MARK REGISTERED



Ordinary Oils Drip Out



NON-FLUID OIL Stays in

NON-FLUID OIL does not leak out at the ends of bearings as ordinary oils do, to cause messy, hazardous floors and surroundings.

Where ordinary oils creep or throw onto armatures and cause burnt out windings from oil-soaked insulation, NON-FLUID OIL remains in vital motor bearings and provides perfect protective lubrication until entirely consumed.

For motors of ball and roller bearing types, heavier grades of NON-FLUID OIL offer additional advantages, depending upon the method of application and temperature conditions encountered.

For safe, cool, long-lasting motors that cost less to maintain, write for NON-FLUID OIL Bulletin No. 504 and free testing sample.

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Also represented in principal industrial centers, including Pittsburgh, Pa., Cleveland and Cincinnati, Ohio

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture. So-called grease imitations of NON-FLUID OIL often prove dangerous and costly.

Circle 9010 inside back cover.

LETTERS

Your views are welcome in this column. Address "Letters, Plant and Power Services Engineer, 111 East Delaware Place, Chicago 11, Ill." Letters should be brief and confined to the editorial of this magazine or other topics of interest to the power services field.

Quite a stir!

Will you please send me a copy of the following: PLANT EQUIPMENT: TO LEASE OR NOT TO LEASE.

W. R. PERRY
Manager of Marketing Services
American-Standard
Industrial Division

Would you kindly send me a tear sheet of the article: Plant Equipment: To lease or not to Lease.

LEONARD ENNIS
Controller
National Wholesale Dry Goods Association

Please forward copy of the following: Plant Equipment: To Lease or not to Lease (Article) February, 1959.

IRENE BUONO
Marketing Research Dept.
Raytheon Manufacturing Co.

No can do

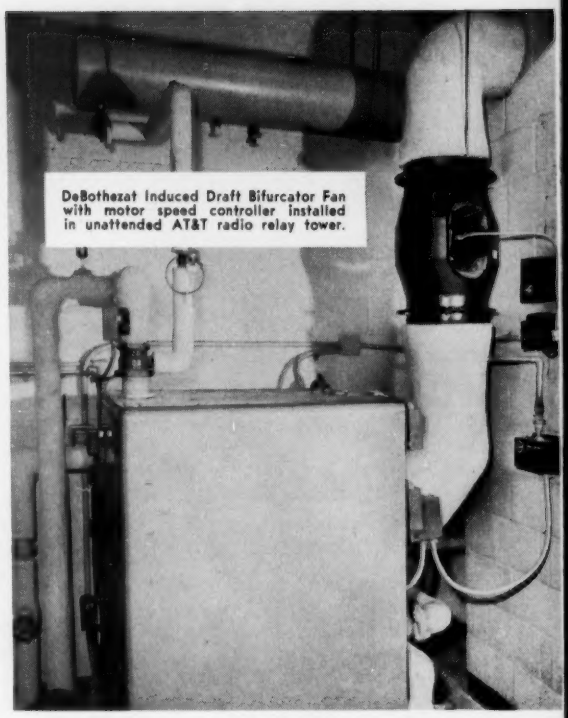
. . . would appreciate copy of "Power & Progress" mentioned in Reports in Brief story entitled "Evolution of Electricity" from Edison Electric Institute.

ALVIN H. RUBY
Manufacturing Engineer
York Division
Borg-Warner

. . . would appreciate copy of Edison Electric Institute "Power & Progress" described on page 7, April issue.

BERNARD F. WINKELMANN
Electrical Engineer
US Army Engineer District

• *We would be very happy to supply readers Ruby and Winkelmann with copies of this report. Unfortunately, as there is a small charge for copies, we cannot, and those interested in securing them must write directly to the Edison Electric Institute, 750 Third St., New York 17, N.Y.*
—The Editors



DeBothezat Induced Draft Bifurcator Fan with motor speed controller installed in unattended AT&T radio relay tower.

THIS IS WHERE dependability counts for Induced Draft Fan

This installation of a DeBothezat Induced Draft Bifurcator® is typical of numerous others in unattended radio relay towers of the American Telephone and Telegraph Company. A dependable, controlled draft helps maintain correct temperatures that safeguard the performance of sensitive electronic equipment.

This Induced Draft Fan utilizes a direct motor drive which eliminates any chance for belt failure. The fan motor mounts in a separate insulated chamber and hot flue gases are bypassed around it.

DeBothezat Induced Draft Bifurcator Fans install just like a section of breeching or duct-work. This saves on space and installation costs. Bifurcators can be equipped with motor speed controllers which regulate draft according to exact boiler requirements. For more details, see our section in Sweet's Plant Engineering File . . . or write.

FOR FURTHER INFORMATION
SWEET'S PLANT ENGINEERING FILE
OR WRITE FOR COPY

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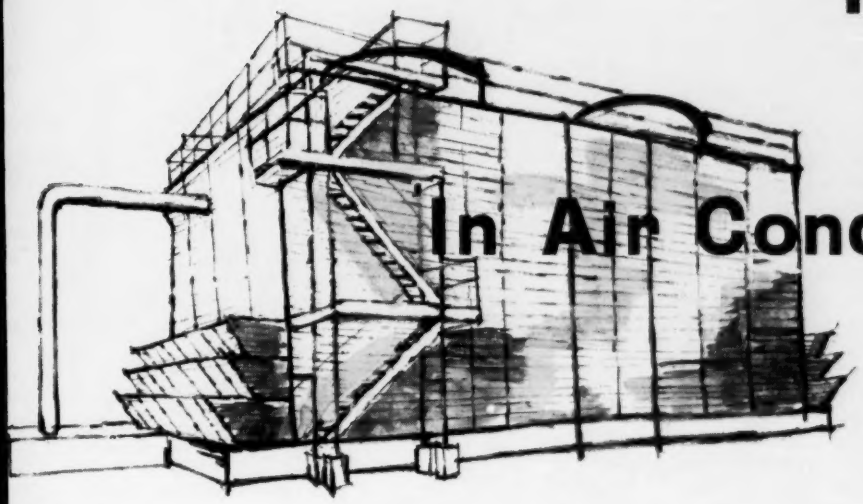
Circle 9011 inside back cover.

Water Problems

JUNE, 1959
VOL. 75 NO. 6
Plant-Power Services Engineer

The how's, why's, and when's of . . .

Tackling Water Problems In Air Conditioning Plants



JOHN L. THORNLEY
Chief Chemist
The Bird-Archer Company
Philadelphia 40, Pa.

Water is one of man's best friends — and it can also be his worst enemy. As a good friend, it has found untold use in producing comfort for man in both heating and cooling. However, in this article we shall concern ourselves with the use of water for cooling only.

Ever since the first man noticed the pleasant, soothing effect of water on his skin when he bathed in a river, water has been used for cooling. Today, it is used in modern air conditioning plants in a variety of applications. As the plants become more elaborate, so do the objectionable properties of water become more of a problem.

The principal objectionable feature of water is its solvent property which causes it to dissolve materials from the air and from the soil over or through which it passes. These materials eventually deposit out as scale in a water-cooled unit or cause corrosion of metal parts.

Water is also the natural habitat of algae, protozoa and other minute organisms which form slime and biological growths. These can seriously affect the operation of a water-cooled system — by impeding heat transfer, restricting the flow of water and initiating and sustaining corrosion reactions.

The three main uses of water in air conditioning are in humidity control systems, chilled water systems, and condenser cooling systems. The destructive effect of water varies with each of these types of systems. The methods of combat are not so varied, but when properly used will reap large rewards for the user.

Accompanying this article is a table that shows the difficulties encountered in the use of water in air conditioning and the ways to overcome them. This table is discussed below.

Humidity Control Systems

The air washer commonly used for ventilation consists essentially of a chamber wherein the air to be conditioned is brought into intimate contact with a dense spray of water. Neither adding or subtracting heat from the spray water will cause the air to become saturated, and the unit functions as a humidifier. By chilling the water, it can be made to function as a dehumidifier.

Air washers operating on a humidifying cycle are constantly evaporating water and are constantly drawing makeup into the system. The dissolved solids which enter with the makeup remain in the system and concentrate.

If the concentrating effect is not controlled, precipitation can take place, and scale can form in the recirculating lines and spray nozzles, restricting flow of water and lowering efficiency of the unit.

Control of concentration should be maintained by continuously bleeding a portion of the circulating water to waste and making up with fresh water. This is comparable to the continuous blowdown system used in boiler operation.

Slime is controlled by use of chlorine, phenolic or quaternary ammonium compounds, or other agents, and by periodic cleaning. Ordinarily, a weekly cleaning of nozzles and tank is sufficient.

Depending upon conditions, corrosion of metal is controlled by pH adjustment of the water and by use of phosphates, chromate or nitrite.

If carryover of solids from the water occurs, this is usually a function of design. The proper placement of eliminators will catch entrained drops of water. Erosion of spray nozzles is also a function of design. For some units, periodic replacement of caps or of nozzles is required.

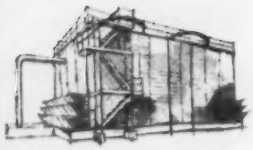
Air washers which function as dehumidifiers are constantly taking moisture from the air and, thus, continuously overflowing to waste. Scale formation is not generally a problem here, but corrosion and slime formation occur.

Slime control agents and corrosion inhibitors are used to combat these conditions. However, an additional problem of maintaining treatment balances results, since the system continuously overflows some of the treatment to waste.

Chilled Water Systems

These systems carry chilled water from a refrigeration

To next page



Water Problems

From page 13

unit to a point where heat is absorbed and cooling results. As they operate with little or no makeup, the only problem in a well-operated system is that of corrosion.

Corrosion is easily controlled by use of sodium chromate in the range of 500 to 1000 parts per million and by maintaining the pH of the water at 6.8 to 7.5.

If pH values are carried too high, dezincification of brass parts of the system results; if pH values are low, acidic corrosion occurs.

Condenser-Compressor Coolers

• Once-through systems

These systems are used in plants where there is a plentiful supply of water, as the water passes through the system once and is discharged to waste. Rivers, ponds, or wells are usually the source of supply.

Corrosion is the chief difficulty encountered here, since the water is generally saturated with oxygen. Polyphosphates or silicates are used to inhibit corrosion — the choice depending on the hardness, alkalinity and pH value of the water and the temperatures existing in the system.

Polyphosphates are added at the rate of 2 to 10 ppm and silicates at 14 to 28 ppm. Since food grade materials are used, they can be discharged into streams without objection from state authorities.

Scale formation is sometimes a problem in once-through systems, especially when the supply water is high in bicarbonate hardness. In this case, a polyphosphate is used to hold the hardness salts in solution. A very low concentration (2-10 ppm) of polyphosphate will do the job.

• Open recirculating systems

When a plentiful, inexpensive supply of water is not available, recirculating systems are used. These include cooling towers, evaporative coolers and spray ponds.

A water treatment program is necessary in the operation of such a system since the continued reuse of water leads to the following operating difficulties:

1) Scale formation. Water contains impurities which remain in the system as the water evaporates. As fresh water is constantly added to make up for that lost, more impurities enter the system and eventually concentrate to a point where their solubility is exceeded.

They then deposit out as scale and seriously interfere with heat transfer as well as impeding flow of water. Calcium and magnesium salts are the principal scale-forming agents although corrosion products, precipitated iron salts, and organic matter frequently are found in scale deposits.

An increase in temperature can also be responsible for scale deposition, since soluble calcium bicarbonate becomes insoluble at higher temperatures. Scale deposits can be prevented by the use of continuous blowdown system and by adding sulfuric acid or other chemicals which convert the potentially scale-forming solids to a more soluble form.

2) Corrosion. Metal parts of recirculating systems corrode in the presence of water and oxygen. The corrosion can lead to shutdown and costly replacement. Water of low pH value is more corrosive to iron and steel than water of neutral or high pH.

However, high pH values in circulating water are objectionable because of other adverse effects such as scale deposition, the rotting of wood, and corrosion of aluminum and brass. Therefore, the pH should be maintained in the neutral range of 6.5 to 7.5.

The pH of makeup water may be naturally low—the pH of circulating water may be low due to the absorption of acidic gases from boiler furnace or other equipment stacks. If pH elevation is necessary, it can be done by adding caustic soda.

However, in the case of low pH makeup water, consideration should be given to changing the source of supply if possible. In the case of absorption of acidic gases by the circulating water, consideration should be given to the relocation of the cooling tower to a more sheltered area or to elevation of the gas-emitting stack.

Control of pH alone is not sufficient to prevent corrosion. Corrosion inhibitors must be used in most cases. These include chromates, phosphates, nitrites, and zinc salts and various combinations of chromate and phosphate or chromate, phosphate and zinc salts.

3) Slime and algae. Slime (produced by bacteria and other micro-organisms) and algae growths can accumulate in open recirculating systems. In addition, minute worms and other forms of aquatic life abound here.

Biological organisms are controlled by using slimicides or algaecides in the circulating water. These materials include chlorine, chlorine releasing compounds, sodium

To page 4

HOW TO TACKLE AIR CONDITIONING WATER PROBLEMS

TYPE OF SYSTEM	DIFFICULTIES ENCOUNTERED	HOW TO HANDLE THEM
Humidity control systems	dissolved solids	continuous blowdown
	slime	slimicides or periodic cleaning
	corrosion of metal	pH adjustment and corrosion inhibitors
Chilled water systems	corrosion	500 - 1000 ppm sodium chromate and pH at 6.8 - 7.5
Condenser-compressor coolers		
1. Once-through systems	corrosion	polyphosphates, silicates
	scale-formation	polyphosphates
2. Open recirculating systems		water treatment necessary
	scale-formation	continuous blowdown and treatment
	corrosion	pH 6.5 - 7.5 and corrosion inhibitors
	slime and algae	slimicides and algaecides
	destruction of wood	
	a) delignification	adjust pH to 6.5 - 7.5 with acid
	b) fungus rot	no satisfactory method other than proper pretreatment of lumber; can use weed killers
	c) erosion	continuous blowdown or filtering

DE LAVAL

for process industries

At Rohm & Haas' Lennig plant . .

Long-Life BATTERY GUARDS CHEMICAL PROCESSING POWER

Since electricity is so important to chemical processing, many safeguards have to be employed to insure against power failures.

Rohm & Haas Co. at its Lennig plant in Northeast Philadelphia is using a 60-cell lead-calcium plate battery for dependable switchgear control. The battery supplies power for operating all 13.2 kv and 2.3 kv oil-blast circuit breakers.

Approximately 15% of the plant's electricity requirements are generated as by-product power by the Rohm & Haas steam generating plant. The remainder is purchased from the Philadelphia Electric Co.

The three-wire service comes in across a 13.2 kv bus. Four high-voltage, oil-blast circuit breakers stand guard. Transformers reduce voltage to 2.3 kv, and power is fed through the low-voltage circuit breakers to various parts of the plant.

Rated at 275 ampere-hours, the battery also serves as a ready and dependable source of emergency standby power for the switchroom in the event of a service interruption. Used in full float service, the battery is charged by a 15-kw motor-generator set. Voltage-regulated source holds cell voltage between 2.15 and 2.20 v per cell.

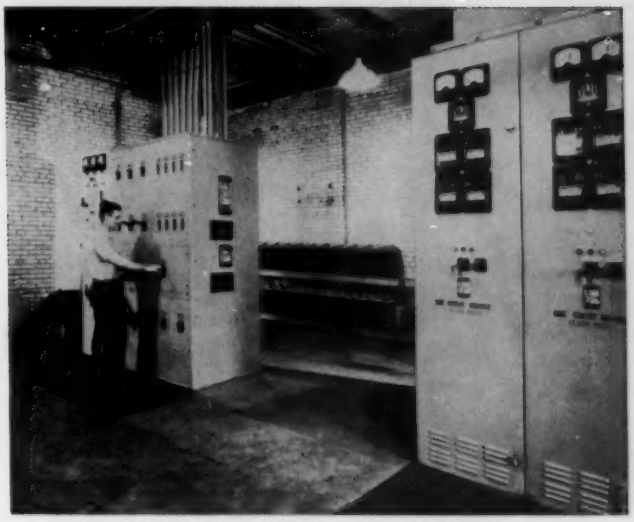
Because this battery requires only between one-fifth to one-tenth the charging current to maintain it in a fully charged condition, the lead-calcium plate battery uses less water on charging than conventional batteries.

As a result, the battery has not required watering during its 18 months of operation.

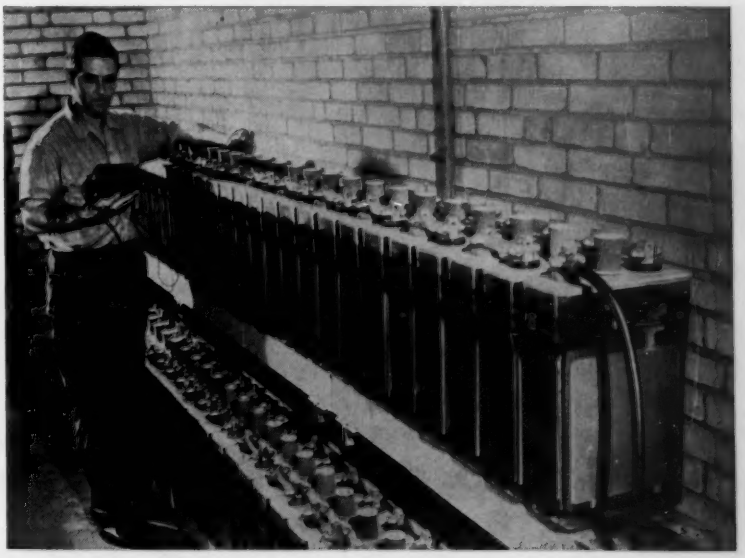
As electrolyte level can be seen at a glance through the clear, plastic, shock-resistant jar, maintenance of the battery is easy. The battery's "Saftee-Vent" with a funnel-shaped opening allows easy thermometer and hydrometer readings — and at the same time guards against a possibility of accidental internal cell explosions.

In performance, the battery provides high one-minute rate, necessary for high instantaneous power surge in switchgear control. Moreover, battery life expectancy is estimated at 25 years.

(PlastiCal battery is a product of C & D Batteries, Inc., Dept. P&PSE, Conshohocken, Pennsylvania.)
Circle 9012 inside back cover.



60-cell lead-calcium battery rated at 275 amp-hr furnishes control power to oil-quenched high-voltage circuit breakers



In full-float operation, with voltage-regulated source holding cell voltage between 2.15 and 2.20 v per cell, battery has life expectancy of 25 years

DE LAVAL STEAM TURBINES

for process industries

The photograph above shows a De Laval direct-connected turbine generator installation at Parke, Davis & Co., Detroit, Michigan.

This controlled extraction, controlled back-pressure unit supplies 2000 kw using process steam. Extraction is at 130 psig, exhaust is 5 psig. This new machine was added to already existing De Laval units that have been in service for 30 years. In addition, the Parke-Davis Research Laboratories in Ann Arbor, Michigan will soon be using a new 1000 kw unit.

Parke, Davis & Co. uses DE LAVAL Steam Turbines for process and power generation

Proved economy, dependable service

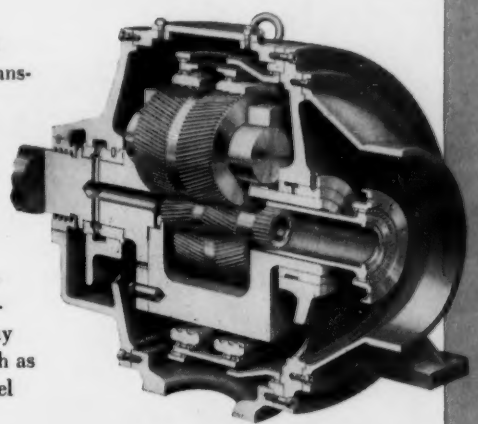
In many process industries, an important by-product is economical electric power. If appreciable quantities of process steam are used, power generation can be achieved at comparatively low cost.

De Laval, pioneer in high speed rotating machinery, has continued to maintain engineering and manufacturing leadership. If you have process application where low-cost power generation can be utilized, call on De Laval.

De Laval-Stoeckicht Planetary Gears

In many applications where high speed and high horsepower are transmitted, the De Laval-Stoeckicht planetary gear can be used to great advantage. It is also used as a speed increaser or decreaser in many industrial installations.

Among its outstanding characteristics are light weight, in-line construction and space saving. It may be used for all kinds of drives such as gas turbines, steam turbines, diesel engines, etc.



Write for Bulletin 2400

DE LAVAL *Steam Turbine Company*

857 NOTTINGHAM WAY, TRENTON 2, N. J.

For more information circle 9013 on reader service card opposite back cover.

THE FUTURE IN SEA WATER

FRED A. LOEBEL

President
Cleaver-Brooks Special Products, Inc.
Waukesha, Wis.

Water shortages exist today in the United States and elsewhere — and the problem is increasing. Some facets of this problem are currently being solved through mechanization — the conversion of sea-water to fresh water. Cost remains the foremost obstacle, but great strides are being made in that direction. Distillation is now economically sound for some communities. Even so, "deserts will not be made to bloom" for a long time, unless some natural solution, such as weather control, is found

Much has been written and spoken in recent months about the problems and techniques of converting sea water to fresh water. Cost figures have often been tossed about which are incomplete and sometimes disregard the facts. Statements have been made which are wholly unrealistic.

It is time, then, to put this whole question into proper perspective — to bring some sort of semblance of fact out of the hodge-podge of assorted half-truths and exaggerations which today are common-place in the profession of desalting water.

Water is the essence of life. Virtually no phase of agriculture, industry, or simple day-to-day activities could proceed without it in some degree. Today the country as a whole is consuming between 250 and 265 billion gallons of water a day. This constitutes a tremendous drain on existing supplies.

At the same time, more and more critical water-short areas are cropping up throughout the world. The need for water is mushrooming not only for human use but industrial use as well.

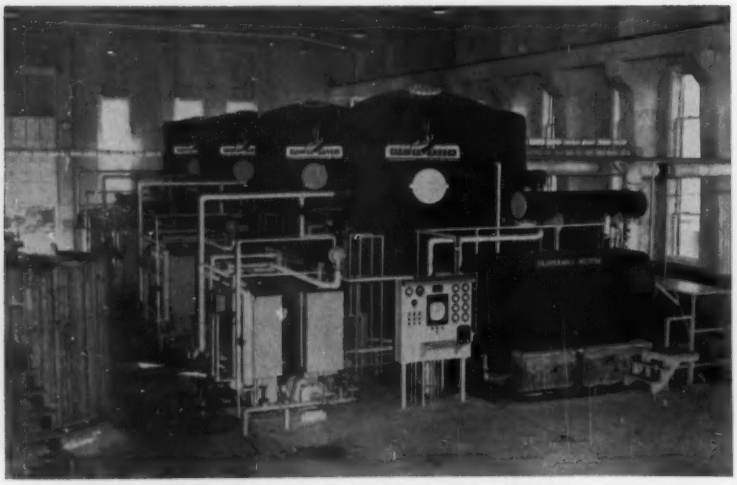
Research figures reveal that within the next 20 years consumption of water in this country alone will double as the economy and population grow apace. Consumption should surpass 500 billion gallons daily by 1975.

This continually increasing drain will result in a major decrease in local water reserves as well as exhaust supplies in some areas.

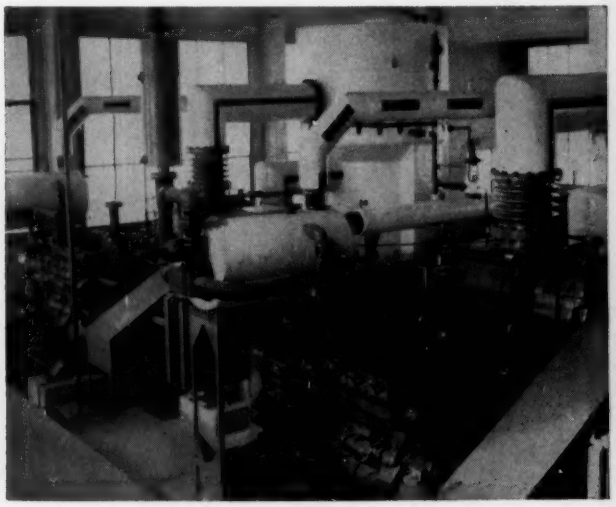
And the problem will not be confined to this country.

For example, many areas in the Middle East have already reached dire straits as far as fresh water sources are concerned.

To date, sea water conversion plants have been erected only in those parts of the world where the production of fresh water by this method is considered economical. Some of these plants are pictured below.



Vapor compression distilling plant with a total capacity of 200,000 gallons a day installed at the Kindley Air Force Base, Bermuda. Each of the four separate units is rated at 2100 gph.



Over 50,000 gallons of distilled water a day is provided by these desalting units in Port Etienne, French West Africa

Sea Water Conversion *From preceding page*

CONVERSION

With limited rainfall, burgeoning populations, and coast lines fronting on salt-bearing waters, the situation is critical.

What's the answer?

We believe part of the answer lies in mechanization — machines which will convert sea water to fresh water.

This subject has long fascinated mankind.

Sailors with parched throats under flagging sails have dreamed of it. Agricultural visionairies, looking over vast arid lands, have thought of it. Modern industrialists talk of it.

Cost

And great strides have been made in the design and engineering of conversion equipment. Nonetheless, cost today remains the No. 1 obstacle.

No other commodity sells at such a wide price variation as water. In Milwaukee, municipal water costs up to 21 cents per thousand gallons, or about $70 per acre foot. At the other extreme, we have various bottled waters from 15 cents to about $1.00 per gallon, or $50,000 to $325.000 per acre foot. Water suitable for medical purposes in small containers (sterile, pyrogen-free distilled water) comes to $10 million per acre foot.

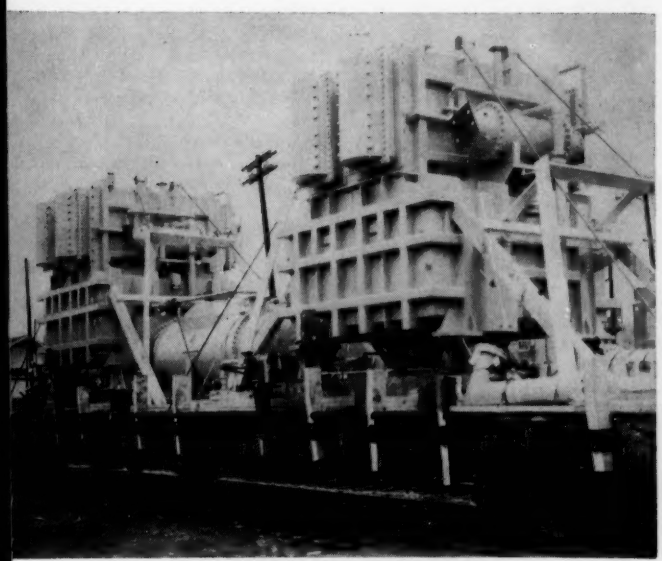
The costs of other municipal and suburban waters are well-known, and prices which range to about $200 per acre foot are not uncommon. In Nassau, well water sells for about 80 cents per thousand gallons, or about $260 per acre foot. About 60 percent of this is represented by cost of production at the wells and storage.

These municipal and suburban costs relate to water found in either surface or underground supplies. The water has not been processed in any type of plant, except, perhaps, by softening, filtering, or chlorination, and is merely distributed by means of pumps or pipelines.

Assume that water can now be made in large plants for about $1.00 per thousand gallons, **when all costs are included.** This is a realistic figure. A thousand gallons of water weighs a little over four tons. We would, therefore, have a price of about 25 cents per ton. We have found no common material that seems to approach this cost. Common salt is about $15 per ton, and limestone about $2.00 per ton.

Even ordinary dirt fill costs over 25 cents per ton delivered, so we can truthfully say that today distilled water can be manufactured from sea water at a cost which is cheaper than dirt.

There are two other important considerations that have a bearing in arriving at a proper perspective as to the cost of water. For one thing, figures of $40 and $125 per acre foot are essentially prices concerned with water that is given "free" by Nature. This natural process employs "fuel" which is free, and the process is moreover carried on in natural surroundings which are also "free". As soon as we confine this natural water in even the simplest kind of equipment, such as pipelines and pumps, we immediately incur substantial costs.



Two 70,000 gallons per day flash evaporators have been shipped for use on the first nuclear-powered aircraft carrier, the USS Enterprise

Some Existing Processes

Regarding existing processes, at Cleaver-Brooks we have always employed evaporating means for conversion, although our policy has never limited us to this technique. At the same time we have continually sought more economical methods regardless of what the processes might be. To date, however, we have found no way to supplant evaporation, which we classify in the following categories:

- **Submerged Tube**

There are some plants of this old and widely used design in operation on sea water which are among the most successful installations from a mechanical standpoint. We believe, however, that some basic limitations to this system have been indicated in sufficiently definite form to strongly suggest that the present trend to other types will continue.

- **Long Tube Vertical**

The Office of Saline Water has done some research and pilot plant work on the long-tube vertical plant and has selected it as the first of five demonstration plants covered by the Anderson Bill and recently approved by Congress. There are no installations on record of this type of plant for sea water, although it has been used for salt brines. Apparently, the success of this type of plant is contingent on a feed treatment system which will prevent scale formation, as well as corrosion control, so that steel tubes can be used.

- **Vapor Compression**

Where the raw water can be readily treated by softening, this is, perhaps, the most favorable method known today. It is usually used for sea water evaporating applications which fall within these approximate limits: relatively small plants, up to 200,000 gallons per day; fuel difficult to procure or relatively expensive; good maintenance facilities available.

This type is highly efficient and compact and as such is usually ideal for many military uses.

This process, too, has limitations which preclude it from consideration for large-scale sea water plants now. Future improvements may make it more favorable, if not one of the best ultimate answers. The low energy requirement is attractive where primary

To next page

energy must be used as compared with waste heat.

Although the first cost would be high, it is interesting to contemplate that with enough heating surface and an efficient compressor, a machine using this process could be built today which would come closer to the theoretical 2.8 kilowatt-hour per thousand gallons of pure water from sea water than any other available process.

• Multi-stage Flash

In recent years our efforts in research, design, and manufacturing have been mainly concentrated on the low temperature multi-stage flash evaporator for marine and land-based applications. We continue to offer vapor compression and submerged tube types, but the flash evaporator is more widely applicable for the following reasons:

a) It operates substantially without scale; b) it is simple to operate and maintain. There are few controls and moving parts; c) it can use a relatively low level heat source; d) first cost is favorable.

It follows that this type is a good choice when waste heat can be used, as, for example, for diesel engines. When combined with a power plant using steam from condensing-extraction turbines, the cost of water is about $1.00 per thousand gallons.

The technique is rapidly gaining wide acceptance in the marine field. For example, this process was used for the 70,000-gallon-a-day distillation units on the USS Enterprise, the country's first nuclear-powered aircraft carrier. The four units compose the largest distilling plant — 280,000 gallons daily — ever placed on a sea-going vessel and will also make it the largest conversion plant in operation within the confines of the United States.

Costs of Existing Processes

The combination of multi-effect or multi-stage flash plants with electric power plants has gained favor in recent years. A few plants of this type have been installed, and others are now being considered. This type of arrangement results in one of the most economical ways of converting sea water.

The amount of water that can be obtained from a steam power plant by using extraction steam from the turbine for heating the evaporator will vary somewhat, depending on many factors. A figure of 7½ gallons per kilowatt hours, however, has proved to be a factual figure in a number of actual projects we have investigated. Based on an electrical consumption of 8 kilowatt-hours per person per day (which is reasonable for an industrial area), we see that the water production in this way would be 60 gallons per person per day.

Let's take a look at what the $1.00 figure would mean for domestic consumption where water is in short supply.

In the United States, the consumption per capita for all uses is about 1000 gallons per person per day. For municipal and rural use, it is about 100 gallons per person per day. With some attention to conservation, this 60 gallon figure is quite adequate. This, of course, does not include uses such as lawn sprinkling. The monthly water bill at $1.20 per thousand gallons, including distribution, would be $2.15 per person, which does not seem unreasonable. In such a community, it follows that agriculture could not exist unless water could be obtained in some other way, by reuse, reclamation, and other sources not suitable for human use.

For a number of current projects, costs for a "combined" plant have been figured by considering the water as a by-product of electric power. This seems logical and has been acceptable to a number of power companies, since electric power is able to stand on its own feet, whereas water is generally not.

When a water plant is added to a power plant, the turbine takes more steam, and the boilers must be larger. The customary way to figure cost of water is, therefore, to charge the water plant for all additional costs which the power plant incurs, as compared to operating alone with conventional generating and condensing equipment.

A set of cost figures for a million-gallon-per-day plant, combined with about a 5500 kilowatt electric load, is shown in the accompanying table.

Future Plants

One of the most significant developments in this regard was the recent announcement that Southern California Edison Company, Los Angeles, Calif., has awarded our company a contract to provide evaporation equipment for a pilot plant to convert sea water to fresh water. The demonstration unit, to be operated in conjunction with existing steam generating facilities, will be the first of its kind in the country.

The contract, in excess of $100,000, calls for the construction of a sea water distillation plant with a capacity of about 100,000 gallons a day.

The plant will be erected at Southern California Edison's Mandalay Steam Station about three miles west of Oxnard in Ventura County, California.

Purpose of the conversion plant will be to serve as a pilot unit to demonstrate the size and other factors for extrapolation to capacities of 5 to 10 million gallons a day.

Southern California Edison officials indicate that the experimental water conversion plant will be used to search out the most economical methods of extracting potable water from sea water.

It was also revealed for the first time that our engineers plan to utilize a new principle in the distillation equipment for this application. The development, which we have been researching for several years, greatly reduces the required heat transfer surface and pumping power—important cost factors.

Edison officials point out that the pilot plant will not be of sufficient size to freshen enough water for commercial use. The water from the plant will be use to supply some of the fresh water needs of the Mandalay Steam Station.

Nonetheless, the development is being recognized as a significant step toward the country's eventual goal of tapping the ocean's supply of water for use in home and industry. Edison officials caution that the water produced by this plant is not expected to compete in cost with present Southern California sources. However, it is acknowledged that such plants could be important to local areas of high water costs — and as equipment and operat-

Costs for a 1,000,000 GPD (net output) Sea Water Distilling Plant

	A	B
1. Investment	$1,534,900	$1,000,000
2. Working Capital	61,000	55,000
3. Operating Costs	$/day	
Fuel and power	$550	$550
Amortization	300	200
Other	165	150
	$1015	$900
4. $/M Gal	$1.02	$0.90

Costs included are quite complete.

Investment includes transportation, insurance, erection, water storage, interest on capital during construction, engineering, contingencies, and site. Annual costs includes 20-year (4 percent) amortization, 4 percent interest on investment and working capital, all maintenance, labor, supplies, fuel, power, taxes and insurance.

Column A represents a multi-stage flash plant heated by steam at atmospheric pressure from a 6000-kilowatt extraction-condensing turbine. Steam to turbine at 600 psig and 820°FTT. Fuel at 8.5 cents per gallon. Steel construction with non-ferrous tubes and tube sheets.

It can be seen from Column A that if amortization is completely eliminated, we still have a cost of about 70 cents per thousand gallons. Even much larger plants do not seem to reduce this cost figure greatly. For example, if only the basic material is included, thus eliminating all costs for transportation, labor, overhead, and profit, the cost of water, using the means described above, would only be reduced by about 15 cents per thousand gallons.

The costs apply to multi-stage plant, which is fairly efficient, about 5½ - 6 lb of water per lb of steam. The plant could be made more efficient, but cost studies show that for the conditions upon which the costs are based, the carrying charges for more investment would outweigh the fuel saving.

Column B is for a similar combined plant, but includes foreseeable improvements in design and manufacture which are currently in the works.

ing costs are driven down through research, development and test, could have more widespread application.

Current State of Progress

We believe that cost progress has been good with regard to plants for domestic, marine and some industrial uses. During the past decade, the installed sea water distilling plant capacity throughout the world has grown substantially. Our own company has produced over 4000 units of all sizes and shapes with a total fresh water capacity of over 16 million gallons a day.

Concerning the conversion of sea water for agricultural use, it is evident that we still have a long way to go. There appears to be no factual evidence today which suggests that a price appreciably below $100 per acre foot, if all costs are considered, will be attained in the near future. There is, moreover, room for doubt that a figure this low can be attained with any process now known. My figures suggest a minimum somewhere around 70 cents per thousand gallons.

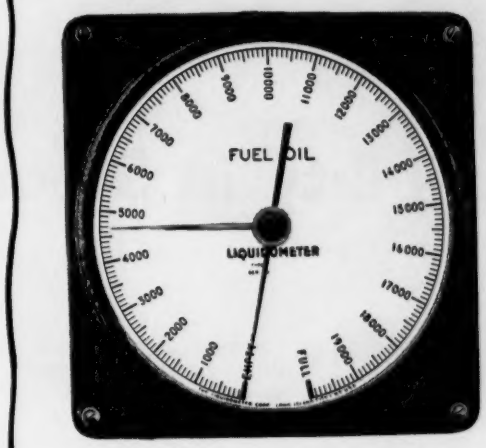
Future Research and Development

With regard to reduction of costs in the future, it is difficult to visualize a cost as low as 50 cents per thousand gallons in any type of a process which must be confined in a plant, such as in an evaporating plant, electrolytic cells, or other devices.

In Milwaukee, for example, water is obtained very simply by pumping it out of Lake Michigan, followed by filtration. Selling price is about $70 per acre foot. Let us imagine a hypothetical sea water conversion plant and assume that this cost at least would be incurred for pumping.

In addition, power or heat is required to separate the salts from the water. This figure is theoretically 2.8 kilowatt hours per one thousand gallons. Present processes are about three to five percent efficient. If we ulti-

To page 50



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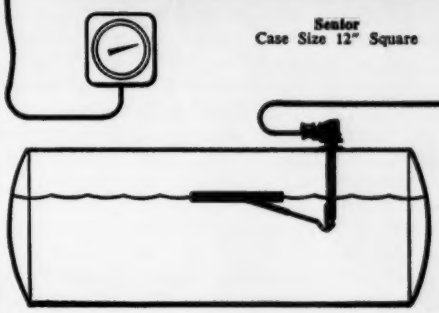

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Circle 9014 inside back cover.

LOOKING FOR A

HTHW BOILER?

Read about the latest development in boilers. This story is in the NEW DEVELOPMENT section which starts on page 28. You'll find descriptions of many other types of plant and power services equipment there, too.

NEW!

Keeps Pipe Joints Lubricated on Temperatures Up to 1050° F.

This new, proven thread compound has no equal for high-temperature/high-pressure installations. Provides better lubrication when assembling screwed or flanged joints . . . prevents seizure and galling when taking down. Crane Formula 425-A doesn't deteriorate in can. Conforms to Military Specification MIL-A-907. Stocked in 1- and 4-pound cans by your local Crane Branch or Crane Wholesaler.

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Circle 9015 inside back cover.

At Pilgrim State Hospital, use of regulator valves with unique pilot hook-ups gives . . .

Maximum Flexibility in Steam Pressure

Pilgrim State Hospital operated by the Department of Mental Hygiene of the State of New York at West Brentwood, Long Island, N. Y. is physically a self-contained city of approximately 12,000 patients and 3000 employees.

The institution generates all its own electrical power (27,000 kw hrs in August) and supplies steam for heating over 100 large buildings as well as for cooking, laundry service, domestic hot water and heating a large greenhouse. During the winter months the main power plant (6 boilers and 4 turbo-generators) produces 4,800,000 lb of steam per day at 155 psi.

Because the hospital is far removed from supplementary sources of steam, and because it is a hospital, steam service must be dependable. To achieve the maximum in dependability and flexibility, the engineering department at the hospital has designed several ingenious control and piping systems.

Steam is used to three pressures. For most of the year, exhaust steam at 5 psi from the turbines is piped for space heating through 25 miles of underground tunnels which also contain water, electrical and higher pressure steam lines. Steam is also used at 25 psi for heating cooking vessels in the kitchens of the various buildings and for steam tables. Steam at 108-110 psi is used for ironing and pressing in laundries. It is also used at 50-60 psi to operate some of the main regulating valves.

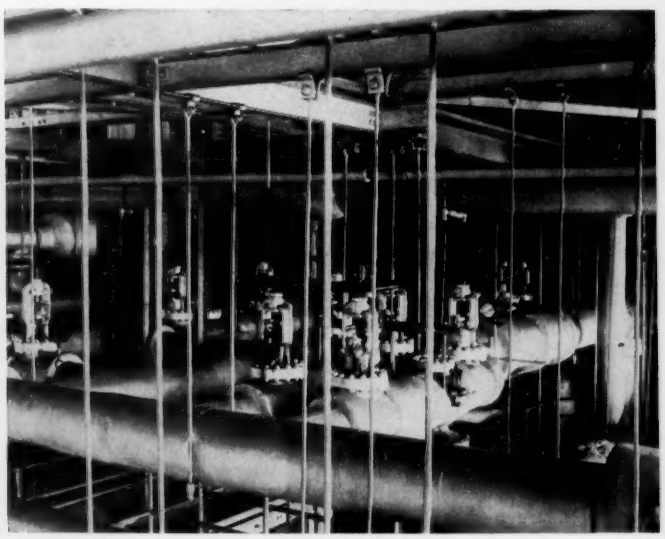
Steam for auxiliary purposes is reduced from 155 psi as it comes from the boilers to 55 or to 3½ psi in a novel arrangement of seven 8" regulating valves. In general, the regulators and piping system reduces steam pressure from 155 to 108 or to 55 psi.

However, if the pressure in the heating main should fall below 3½ psi, two of the 8" regulators in the system will open automatically permitting steam at 3½ psi to flow to heating main. These two valves in parallel reduce the pressure from 55 to 3½ psi.

The boiler steam flows through a branch pipe where two 8" valves in parallel reduce the pressure to 108 psi for laundry service. Boiler steam flows through two 8" regulators in parallel which reduce the pressure to 55 psi for cooking and steam table use in kitchens.

Although the system operates most of the time as described, the system is valved and connected so that a number of combinations of pressure reductions and steam flow are possible. Several of the pressure reductions are made in parallel regulators so that one regulator can supply a minimum of steam while the other is being inspected or the strainer in the line is being cleaned.

Two valves in parallel provide capacity for peak loads. All of the pilots are interchangeable on any main valve in the hospital. A minimum



Indicator panel shows steam pressure in all lines in distribution and pressure reducing system. Steam enters system at 155 psi and is reduced to 105-108 psi, 55-60 psi and to 3-3½ psi through seven 8" regulating valves

Control

GEORGE T. HOOVER
Chief Stationary Engineer
Pilgrim State Hospital
Brentwood, Long Island, N. Y.
with P&PSE Staff

stock of spare pilots is required.

Exhaust steam from the turbines also heats water for ordinary domestic use. An instantaneous heater of 33,000 gal/hr capacity receives 5 psi steam through two 12" regulators controlled by temperature pilots. These two valves are installed in parallel also. When the temperature in the instantaneous heater reaches the required value (150°F) the vapor pressure in the capillary tube exerts pressure on the pilot throttling the main valve until it closes.

The engineers have devised a unique system for the two pilots. Pilots are connected so that either pilot can control both main valves in addition to controlling the main valve to which it is attached. Because of the low pressure of steam passing through the main valves (5 psi), auxiliary steam at 30 psi is required to actuate the main valves. High pressure steam from the boilers at 155 psi is reduced to 30 psi in a ½" direct-acting regulator in the supply line to the pilots.

Turbine exhaust steam also heats water for the laundry. Steam flow to the storage heater is controlled by a 12" regulating valve with a temperature pilot.

As in the case of the instantaneous heater, this pilot also receives auxiliary steam at 50 psi through a ½" direct acting D valve in the supply line to the pilot. As the water temperature in the tank approaches the maximum, the pilot closes the main valve.

Pilgrim State Hospital actually consists of Pilgrim State proper and the Edgewood Annex. The Edgewood Annex has its own power plant. Several unique regulator applications have been devised in the Edgewood power house.

A new regulator station has just been completed to reduce 155 psi steam to 55 psi. As in other regulator stations in the institution, two main valves are installed in parallel. One is a 4" and the other 6". The 4" regulator handles the summer load and the 6" handles the winter load, although the 4" valve can handle the winter load in an emergency.

Either main valve can be operated by either pilot. In addition, one pilot can handle both main valves. This hook-up affords a maximum in flexibility and protection against valve or pilot failure due to dirt in the line.

An original hook-up has been devised to control the reciprocating pumps for the feed water receivers for the boilers. Steam is reduced from 155 to 30 psi to drive the pumps in a 1½" regulator with a D pilot and a P pilot in series.

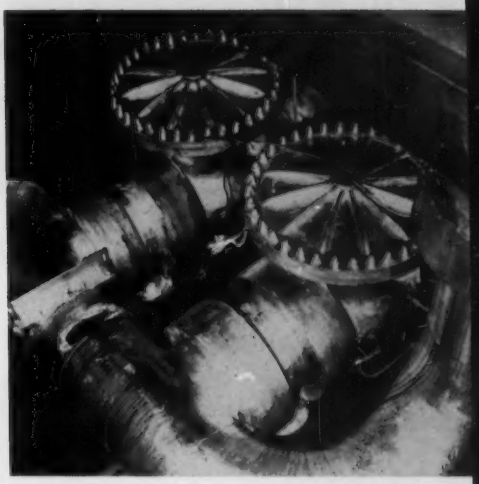
The P pilot is connected by piping to the receiving tank on an upper level so that there is a hydraulic head of 23 psi when the tank is full and 21 at the lowest permissible level. The hydraulic head acts on the diaphragm of the P pilot. At 23 psi, the head closes the P pilot which closes main valve and stops pumps.

When the water level in the tank falls, the P pilot opens and the D pilot takes over and regulates the steam pressure to the pumps. However, any accidental build-up of pressure in the line from tank to the pilot might prevent the P pilot from opening when the water level falls.

To avoid this, a gate valve actuated by the float in the line from the tank to P pilot was installed. When the water level is down the valve closes which prevents any residual head from acting on the P pilot. In addition a needle valve between the gate valve and the P pilot permits any artificial pressure to bleed off.

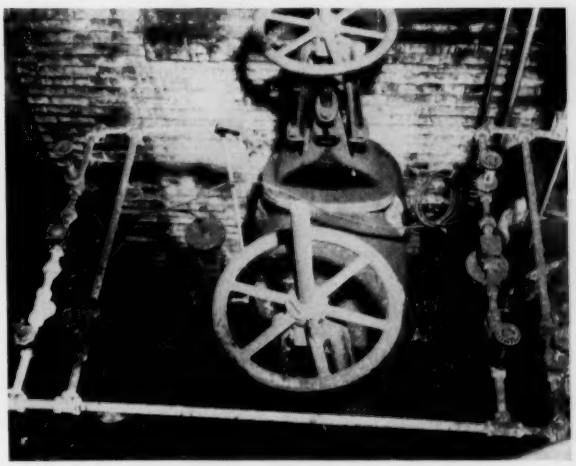
(Regulating valves are manufactured by Spence Engineering Co., Inc., Walden, New York.)

Circle 9016 inside back cover.



These two 8" regulators connected in parallel reduce steam pressure from 55 psi to 3½ psi from main steam lines whenever exhaust steam from turbines is not sufficient

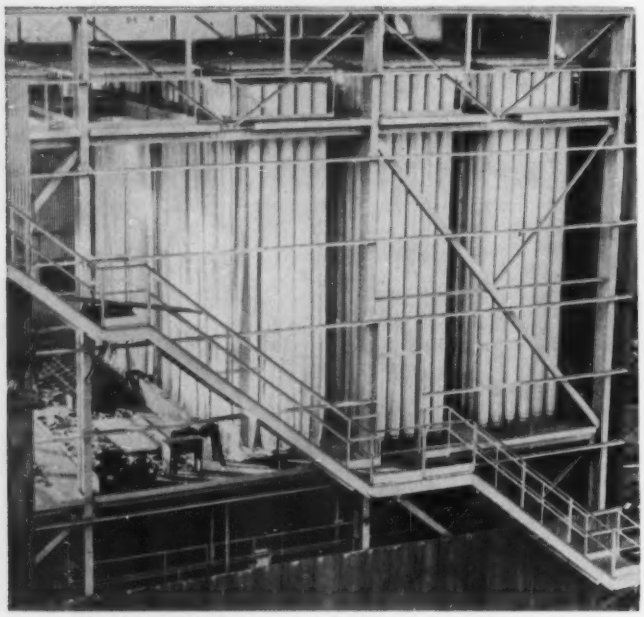
Maximum flexibility is obtained through unique regulator and pilot hook-ups. Here a 4" main valve (left) handles summer load and the 6" (right) the winter load. Pilot hook-up permits either pilot to control either valve or either pilot to control both valves. In an emergency, regulators can be used simultaneously



In another case, pilots are connected so that either pilot will control both 12" regulators furnishing 3½ psi steam to an instantaneous water heater. Auxiliary steam at 60 psi is piped to pilot to give sufficient operating pressure

NEW SOLUTIONS

for your plant and power services problems



Twenty-five foot long bags collect dust and fumes from electric arc furnaces

Smoke problem is in the bag; eliminates pollution worries

With the installation of a filter type dust and fume collector, Bethlehem Pacific Coast Steel Corp., Seattle, Wash., now has all smoke and soot from its two 100-ton capacity electric arc furnaces under complete control.

This is the first steel plant in the West to have such a facility for smoke control. Working like a vacuum cleaner, the system collects smoke and fumes in special bags 25 ft long and 12 inches in diameter made of silicone-treated woven glass fabric. This fabric will withstand temperatures up to 500°F.

The complete unit contains 792 bags in groups of 66 each, all enclosed in a metal building called the "Bag House." Each bag is collapsed every half hour, and the material clinging to the bags drops of its own weight into hoppers below, where it is removed by conveyors.

(Therm-O-Flex collector is product of Western Precipitation Corporation, Dept. P&PSE, PO Box 2744 Terminal Annex, Los Angeles 54, Calif.)

Circle 9017 inside back cover.

Uses wrought iron pipe for radiant heating, snow melting

In the generation of electric power in the northern areas, snow and ice can be obstacles to normal operations. To overcome these obstacles, Public Service Co. of Colorado installed an "automatic" wrought iron snow removal system at one of its stations.

With the system in operation, "tripper deck" work flows safely and smoothly for maintenance personnel whose duties require spending a considerable amount of time in what would ordinarily be snow-clogged areas. Also, deck heat prevents snow and ice from building up on low, moving parts of equipment.

Located over coal bunkers, the tripper deck provides space for conveyor equipment used to distribute coal to storage bins and into the stokers.

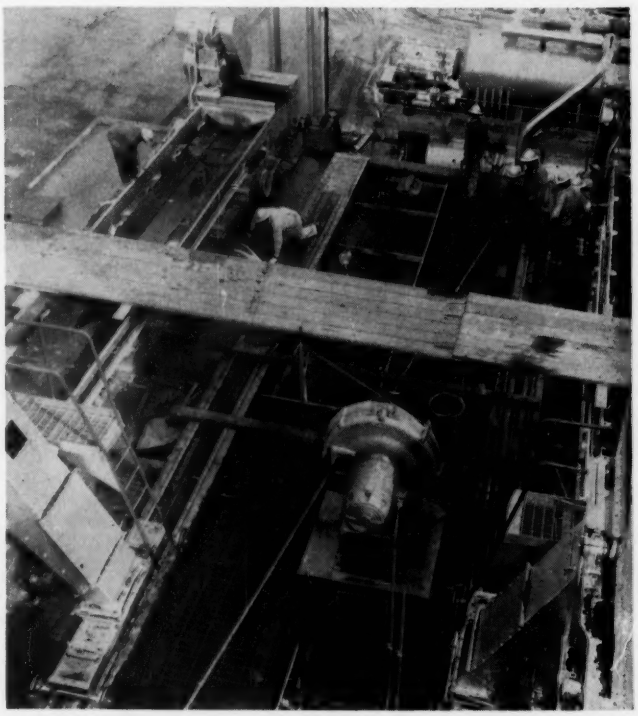
Because it has a coefficient of expansion similar to concrete and is resistant to corrosion, wrought iron pipe was chosen for this job. One-inch pipe was coiled on 11-inch centers and embedded in 5¾ inches of concrete.

Hot water, mixed with antifreeze and heated by a steam exchanger, is circulated through the piping system. Designed to operate at a minimum temperature of 180°F, the snow melting area measures 24 by 50 ft.

A wrought iron pipe radiant heating system was installed in the first floor of the station's office building. Both systems were designed by Ebasco Services Incorporated.

(Wrought iron pipe was supplied by A. M. Byers Company, Dept. P&PSE, Clark Building, PO Box 1076, Pittsburgh 30, Pa.)

Circle 9018 inside back cover.



Wrought iron pipe has same coefficient of expansion as concrete and is resistant to corrosion in snow melting system

Low-velocity air diffusers are attached to central duct prior to installation of ceiling. Flexible tubing carries air flow through pressure displacement valve to diffusion plate below

Eliminates draft, gets neat appearance with air conditioning system

Clean, uncluttered ceilings and freedom to partition where desired has been achieved through use of low-velocity air diffusion concept for air conditioning in a modular-designed industrial project at Sikorsky Aircraft, Stratford, Conn.

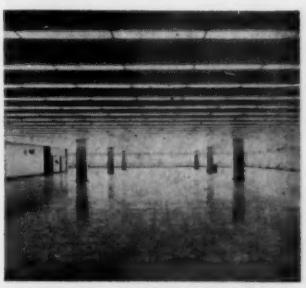
In the installation, 5100 vents have been installed in the acoustical metal pan ceilings of office, general and engineering space. Such a system gives space flexibility and eliminates "forest of fixtures" appearance of ceilings.

The vent fixtures consist of flush-fitting, modular diffusion panels connected by flexible tubing to duct system. By means of a valve arrangement within the panel, the air is slowed to a 30-40 ft per min flow and is gently dropped into the room vertically from a 2 x 4 ft perforated plate.

As this system allows every square foot of the area to be cooled, partitioning can be placed where desired. Each module will be self-sufficient in terms of heating, air conditioning and ventilation.

The diffusers give each module this necessary independence, since the system's draft-free air flow has no "throw" or "bounce" and requires no relocation and rebalance of fixtures if partitions are installed. This lack of draft was also a prime comfort factor of the system.

(Low-velocity air diffuser system is product of The Pyle-National Company, Dept. P&PSE, 1334 N. Kostner Ave., Chicago 51, Ill.)
Circle 9019 inside back cover.



Every square foot of this space is cooled by low-velocity air diffusers located above ceiling

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These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

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109

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Circle 9020 inside back cover.

Chemical added to boiler feedwater forms a protective film wherever condensate forms in steam system

CUTS steam line maintenance 60%

By adding a filming chemical to the boiler feedwater, Whippany Paper Board Company has reduced steam line maintenance more than 60 percent.

The chemical forms a thin protective film on metal surfaces contacted by condensate and effectively controls corrosion.

As the proper use of the chemical is important for best results, a batch is made up every eight hours using hot condensate at temperatures between 130°F and 170°F. The batch is proportioned so that 1¼ parts of the amine chemical is used per million pounds of steam.

Whippany generates about 4,800,000 pounds of steam a day. Proportions were slightly higher when the chemical addition was started. This was done to clean out existing scale deposits and corrosion.

Extraction steam — at about 45 psi — is used in more than 261 dryers on each of the plant's two paper machines. Pipe corrosion and steam trap clogging had become a continual problem in these lines.

At least 18 to 20 nipples had to be replaced every three weeks. Since treatment started — three years ago — these nipples have not been touched.

The surface temperature of the dryers has increased about 20°F since the filming amine in the steam cleaned out old corrosion deposits. In fuel savings, the company now saves 180 pounds of coal for each ton of paper board produced daily.

Actual tests ran to determine effectiveness of the treatment showed a corrosion rate at the outlet of the turbogenerator of only 0.4 mg/dm²/day or 0.0007 inches penetration per year (IPY) during the 5-month testing period. At the steam trap discharge from one of the dryers, a rate of only 1.4 mg/dm²/day or 0.0025 IPY was recorded.

The chemical volatizes in the boiler and passes over with the steam. From point of condensation onward, it forms an extremely thin, yet continuous, non-wettable film. This film protects all metal surfaces, including copper, its alloys, iron and steel, against grooving, channelling, pitting, thread failure and other corrosion damage.

(Hagafilm is product of Hagan Chemicals & Controls, Inc., Dept. P&PSE, Box 1346, Pittsburgh 30, Pa.)
Circle 9022 inside back cover.

Gets fast, dependable thawing of coal cars

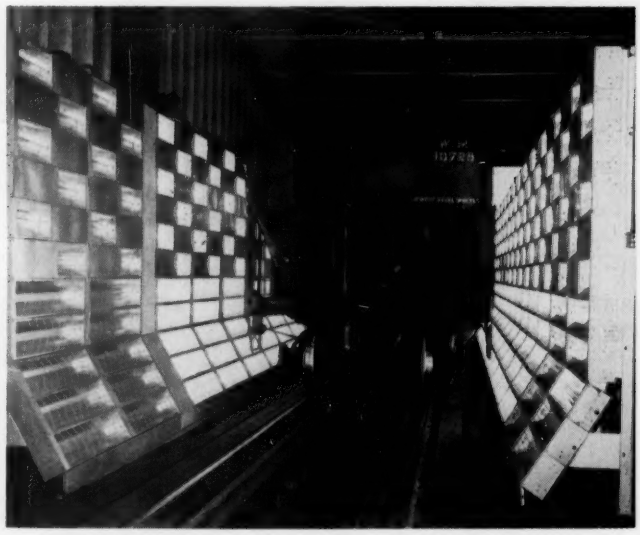
An electrical method using quartz infrared heat lamps to thaw frozen coal in railroad hopper cars has been undergoing tests at Western Maryland Railroad's dockside yards in Baltimore.

Using banks of 1600-watt and 3800-watt lamps, the system has provided a minimum of maintenance, greater speed, increased cleanliness and less damage to railroad cars.

Coal cars enter the "oven", built by the Fostoria Pressed Steel Company, and pass between reflector panels of the infrared lamps. Heaviest infrared concentration is at the bottom of the car.

Although duration of a car's stay in the oven depends upon prevailing temperatures, how solidly the coal is frozen, and the moisture content, tests have shown at least six cars an hour can be thawed and unloaded without need of manual picking of the lading even in zero temperatures.

(More information of thawing system may be obtained from General Electric Company, Dept. P&PSE, Nela Park, Cleveland 12, Ohio.)
Circle 9021 inside back cover.



Coal thawing system uses banks of quartz infrared heat lamps

Tackles high-speed lubrication problem, saves 50%

Problem: In the production of concrete-lined large diameter steel pipe, high-speed revolutions can make lubrication of roller bearings a major headache — and the addition of a continuous water spray to the operation makes the problem even more acute.

At the Lock Joint Pipe Company's Columbia, S.C., plant, lubricant application was required every week and called for loads of grease and high maintenance costs.

In the operation, 16-ft long sections of pipe are spun horizontally at 450 to 600 rpm, while concrete is pumped into the interior permitting the centrifugal force to spread the concrete evenly and uniformly.

Before spinning, the steel pipe is placed into a heavy steel jacket, and the combination is mounted on four rotating wheels.

The entire assembly rests on these wheels — the shafts of which are supported on pillow blocks containing roller bearings. The bearings are subject to friction heat generated by high speed and heavy load. As concrete is centrifugally placed in the pipe, water is squeezed from it. This water drains in a washing action over the pillow block roller bearings.

Solution: Lubrication engineers were called in to study the problem. Their investigation led to the use of a lubricant which required less applications.

The new lubricant, called Gulf XXX Lubricant, is applied only once each month to the small blocks and twice monthly to the large ones.

Results: In addition to protecting the bearings, the lubricant locks out all dripping water. In savings, lubrication material costs have been cut 50%; maintenance time has been cut even more.

(Gulf XXX Lubricant is product of Gulf Oil Corporation, Pittsburgh, Pennsylvania.)

Circle 9023 inside back cover.

Globe valve maintenance cut 25 percent

Formica Corporation, Cincinnati, Ohio, depends on bronze globe valves to control steam used for lamination presses.

Valve operation is frequent, throttling is close and severe. In formerly used valves, erosion and wire-drawing of seats were rapid, permitted escape

Steam lines to presses in Formica plant are equipped with cost-saving bronze globe valves

and loss of steam, and interfered with process control.

Installation of new type bronze globe valves stopped leakage problems, cut valve maintenance costs more than 25 percent. Valves now stay bottle-tight and require no seat and disc maintenance.

These valves have perfectly flat narrow micro-optically finished seats brazed in the valve body. Seats mate with flat discs to give a seating design entirely different from ordinary plug type seating.

Seat and disc are of an alloy noted for its hardness and abrasion resistance. The material is harder than 500 Brinell Stainless steel and is said to outwear case hardened stainless steel exceeding 1000 Brinell, in practical applications.

(LQ600 bronze globe valves are manufactured by Lunkenheimer Co., Waverly and Beekman Sts., Cincinnati, Ohio.)

Circle 9024 inside back cover.

For more information on items reported in the New Solutions section circle corresponding numbers on reader service card inside back cover.

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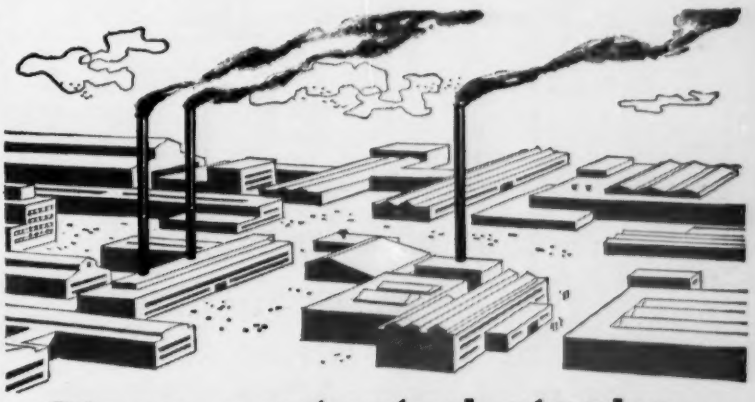
Circle 9025 inside back cover.



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Circle 9026 inside back cover.

NEW DEVELOPMENTS

for

effective plant and power services operation

Remote-mounted boiler water meter keeps check on boiler

Reads, records water to boiler; gives record of boiler output

Remote-mounted boiler meter accurately and inexpensively meters, indicates and records total feed to boiler and gives a permanent record of boiler output.

With this meter, daily feed loads may be read on a continuous integrating recorder. The instantaneous load may be quickly checked visually. Peak load is accurately and permanently recorded on a 24-hour chart.

Thus, by having one instrument that will give all the facts needed instantly, boiler and power plant operations may be checked for maximum efficiency and performance.

Rugged and versatile, the meter is ideal for measuring raw feed makeup, processing returns, and boiler blowdown. All component parts are simple and easily maintained, and the flexibility of installation makes it possible to meet specific requirements of any operation.

(Remote-mounted boiler water meter is product of Power Plant Equipment Division, Henszey Company, Dept. P&PSE, Watertown, Wisconsin.)
Circle 9027 inside back cover.

Gas density recorder gives continuous, accurate readings

Continuous and accurate recording of absolute gas density to meet every type of automatic process controlling requirement is provided with recorder.

Unit operates mechanically and needs no power supply for its drive. Explosion-proof construction is particularly designed to measure combustible gases in hazardous areas.

Recorder works on buoyancy principle, in which the lifting force of displacement element dependent on the gas density is measured. Measuring mechanism is designed as an extremely sensitive balance to which a closed lifting ball filled with gas is attached.

Gas to be tested passes through a gas-proof chamber. By means of a magnetic coupling, the balance deflection is transmitted outside from the gas chamber to the indicating and recording appliance.

Measuring mechanism is equipped with an automatic pressure and temperature compensating device. This consists of box-shaped pressure gage with a metal diaphragm operating on an adjustable compensating weight connected to lifting ball by a capillary tube.

Temperature compensation is effected within a range of 27°F and pressure compensation under normal conditions with a 20″ head of water. Average error or registration does not exceed ±1 percent over the entire range.

Corrosive action of gas is counteracted by abrasion-resistant materials and corrosion-resistant parts.

Balance mechanism is easily set by means of locating device operated from the outside. Recorder can be shipped and installed without damage to its sensitive parts.

To prevent dirt and other solids from entering recorder, changeable filters are fitted on entering and leaving sides. Filters are readily changed by disconnecting tubing, removing the bolts, and inserting new filter.

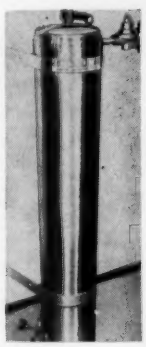
(Recorder is supplied by Air Conditioning Equipment Corporation, Dept. P&PSE, New York, N. Y.)
Circle 9028 inside back cover.

Compact water deionizer does not require regeneration system

Up to 120 gallons of deionized water per hour is provided with compact deionizer. Removable bags of mixed ion exchange resin, when exhausted, are simply lifted out and exchanged for factory regenerated refills.

Service eliminates chore of regenerating, expense of disposable resin cartridges and delays in waiting for replaceable units. Attractive stainless steel deionizer measures only 45 inches in height.

Unit is sized for applications which do not justify a large deionizer, but are too great for portable or cartridge unit capacities. It provides water that is freer from mineral impurities than distilled water at a fraction of the cost of distillation. Delivers between 6300 and 8400 grains exchange or up to 1500 gallons per cycle. Hooks into water supply line and furnishes demineralized water under line pressure at generous rates of as much as 2 gpm. No regeneration is necessary as a result of organized resin exchange service. When effluent resistance falls below 50,000 ohms, built-in ohm meter actuates a pilot signal. Spent material is then replaced with fresh ion exchange resin which the user keeps on hand.



Spent material is returned to manufacturer in furnished containers. Manufacturer promptly regenerates it and returns fresh material to user.

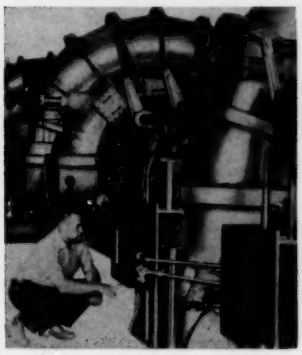
(Water deionizer is manufactured by the Elgin Softener Corporation, Elgin, Ill.)
Circle 9029 inside back cover.

Keeps surges down in compressors

Permits units to operate close to surge point

For large compressors, blowers, and exhausters, fast-responding surge control system improves operating stability, reduces power consumption, and increases safe output.

With the system, compressors can be safely operated nearer the surge point. Unchecked surging can quickly damage or destroy a compressor.



System allows compressors to be operated safely near surge point

Adaptable to every mode of compressor operation, the system is devised for units from 50 hp up. It is a highly flexible, completely packaged system providing complete safety at any level of operation.

Consisting of fully electronic sensing, measurement, and control instruments, the system also has an electro-hydraulic or electro-pneumatic actuator and control valve as the final control elements.

Use of electronic instrumentation eliminates signal lags, and permits compressors to be operated as close as possible to the surge point with consequent gains in output.

(Compudyne Surge Control System is manufactured by CDC Control Services, Inc., 775 South Warminster Rd., Hatboro, Pa.)

Circle 9030 inside back cover.

Simplifies thermocouple conductor installation

One cable contains 6 to 56 wire pairs

A polyvinyl insulated multi-conductor cable for 6 to 56 pairs of thermocouple conductors is easier to handle and install than individual pairs of thermocoupling extension wire.

It can be installed in conduit, without conduit, in open troughs, or in raceways. It is most advantageous wherever thermocouple extensions must be run a long distance from a number of thermocouples to measuring instruments.

When installed in conduit, the cable reduces costs by eliminating the need to pull individual extension wires. It also permits the use of small conduits for the same number of thermocouple extensions.

Individual conductors are insulated in high-temperature (221°F) polyvinyl chloride and then concentrically cabled with overall polyvinyl chloride insulation. Aluminum-backed Mylar tape, wrapped around conductor bundle, provides electrostatic shielding.

The cable is made from either 20 or 16 solid wire or in 17 guage stranded construction when extra flexibility is required. (Each conductor is color-coded according to ISA recommendations.) Thermocouple pairs are numbered alike and lie next to each other — individual pairs and negative and positive conductors can always be easily identified.

All cables contain a copper wire which serves as either a ground or communications wire. All standard thermocouple materials are available, and units come with either 6, 14, 18, 25, 39 or 56 pairs of thermocouple conductors.

Multi-junction terminal boxes, designed to accommodate the cable, are also available.

("Thermo-Cable" is available from Thermo Electric Company, Inc., Saddle Brook, New Jersey.)

Circle 9031 inside back cover.

REMOTE FLOW READINGS *with* **HENSZEY FLOW INDICATORS**

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The Henszey Flow Indicator will accurately indicate the rate of flow of liquids, such as boiler feed water, condensate, gasoline, light oils, chemicals. Simplicity of design makes it possible to offer indicators of many varied cast metals, etc. Indicator registers to within 1.5% of absolute accuracy of calibrated flow in any units (metric, etc.).

The Henszey Flow Indicator fits anywhere in a horizontal line . . . needs no supports. Only three, easily replaced, moving parts assure long, trouble-free operation.

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Circle 9032 inside back cover.

IS YOUR BOILER LITERATURE FILE COMPLETE?

- A new bulletin on boilers is being offered.
- You'll find a review of this bulletin in the New Literature section, starting on page 38.
- This bulletin is just one of some 72 selected items of plant and power services literature reviewed in this issue.

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CHICAGO-WILCOX MFG. CO.

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Circle 9033 inside back cover.

Controls compressible, incompressible fluids indiscriminately

Pilot-operated pressure-reducing valve will precisely control compressible and incompressible fluids indiscriminately (steam, water, gas, oil, air) without any change in design.

Installation is easy since all piping connections are fabricated within the flanges of the main valve, and unit is furnished ready to bolt in place and put in service.

With its ability to activate and sense directly from main valve flanges, the valve presents space saving feature. Fully guided stems enable installation of either pilot or main valve in any position convenient to piping system or location.

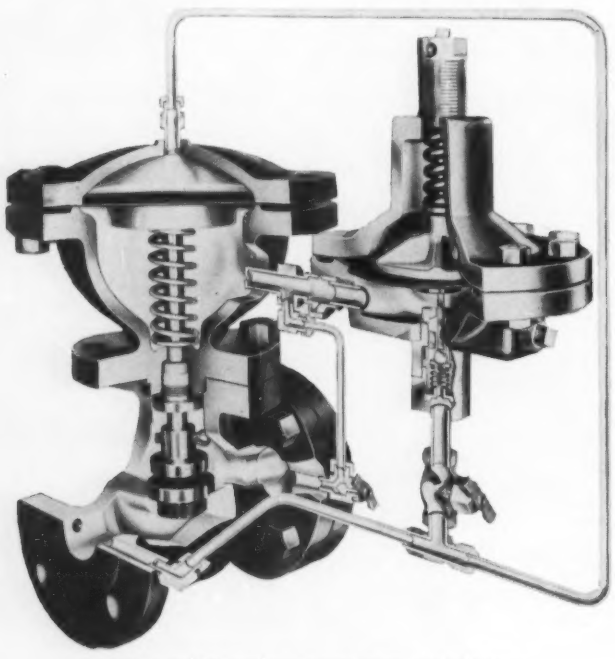
There is no stem bind with Teflon guide and non-magnetic internals. Valve is completely self-contained and packless.

Capable of pressure reductions from 600 psig initial to as low as one psig reduced in one step, the valve makes possible precise reduced pressures adjustable between 0 and 125 psig by use of one of three springs, easily interchangeable, without removing it from service.

Positive dead-end closing force is secured by utilizing full up-stream high pressure magnified in diaphragm area. Disc is moved with guided floating action, automatically aligned to seat securely.

All working parts are readily accessible for inspection and can be reconditioned without removing valve from pipe line.

(Class AD pilot-operated pressure reducing valve is product of The C. E. Squires Co., Dept. P&PSE, 18502 Syracuse Ave., Cleveland 10, O.)
Circle 9034 inside back cover.



Pressure reducing valve presents space saving features

Asbestos safety cloth does not fray

A non-fraying asbestos safety cloth has greater abrasion resistance than plain asbestos cloth. At the same time, it maintains the same insulation characteristics.

Unlike plain asbestos cloth, the fabric does not unravel along cut edges and can be tailored to fit any pattern.

When cut, asbestos cloth will not unravel along cut edges

Because of its high abrasion resistance, plus its lint-free property, the fabric is highly suited for use in fire curtains and fire blankets.

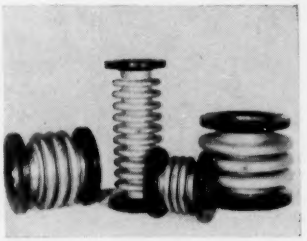
Available in standard widths of 36″ and 40″, the cloth can be furnished in widths of 60″.

(Asbestos safety cloth is manufactured by Union Asbestos and Rubber Company, Fibrous Products Division, 1111 West Perry St., Bloomington, Ill.)
Circle 9035 inside back cover.

Bellows expansion joints in 3" - 30" pipe sizes

Plans for a complete line of bellow expansion joints have been announced. Initial production of stainless steel expansion joints will be in 3″ to 30″ pipe nozzle sizes for applications up to 300 psi and 750°F.

An example of the type that will be available is shown in the accompanying photograph. These include a six-inch reinforced joint (left), a four-inch, ten-convolution unreinforced joint with fixed flanged ends (standing, second from left), a four-inch three convolution unreinforced joint (third from left) and eight-inch unreinforced joint (right).



Four examples of a complete line of bellows expansion joints

Providing a test-rated interrelation between pressure, traverse and cyclic life, the joints are designed for piping layouts where space is highly restricted.

(Bellows expansion joints will be manufactured by Tube Turns Division of Chemetron Corporation, 224 E. Broadway, Louisville 1, Ky.)
Circle 9036 inside back cover.

Gives record of Btu loss or gain

A single recorder is used to continuously record, indicate, and integrate Btu loss or gain of a flowing liquid. Also on the same chart, temperature differential and flow rate of liquid are recorded.

Primary use for the meter is measurement of heat transfer in hot water generators, cooling towers, refrigerating systems, and other such heat exchangers.

This is how the instrument works: Two platinum resistance temperature elements, differential connected and measuring inlet and outlet temperature of the liquid, form two legs of a resistance bridge in which the differential temperature receiver in

the recorder acts as a rebalancing unit.

Liquid flow through the process is also recorded. Differential temperature and flow retransmitting slidewires on their respective receiver units are connected so as to multiply their respective signals.

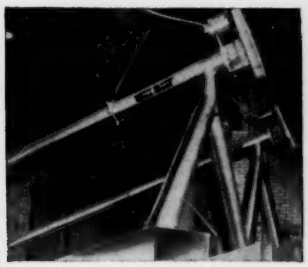
This product represents number of Btu's gained or lost per unit of time by the liquid as it passes through the process. Btu signal is directed to the Btu receiver unit, where it is rebalanced and recorded.

(Model 913 Btu Meter is a product of The Hays Corporation, Michigan City, Indiana.) Circle 9037 inside back cover.

Coal conveyor unjams automatically

When coal jams in this conveyor, it will reverse drive to clear the jam automatically. A two-way, switch-controlled motor drive makes it possible to reverse coal screw rotation.

Coal screw and flanged coal-screw housings are made



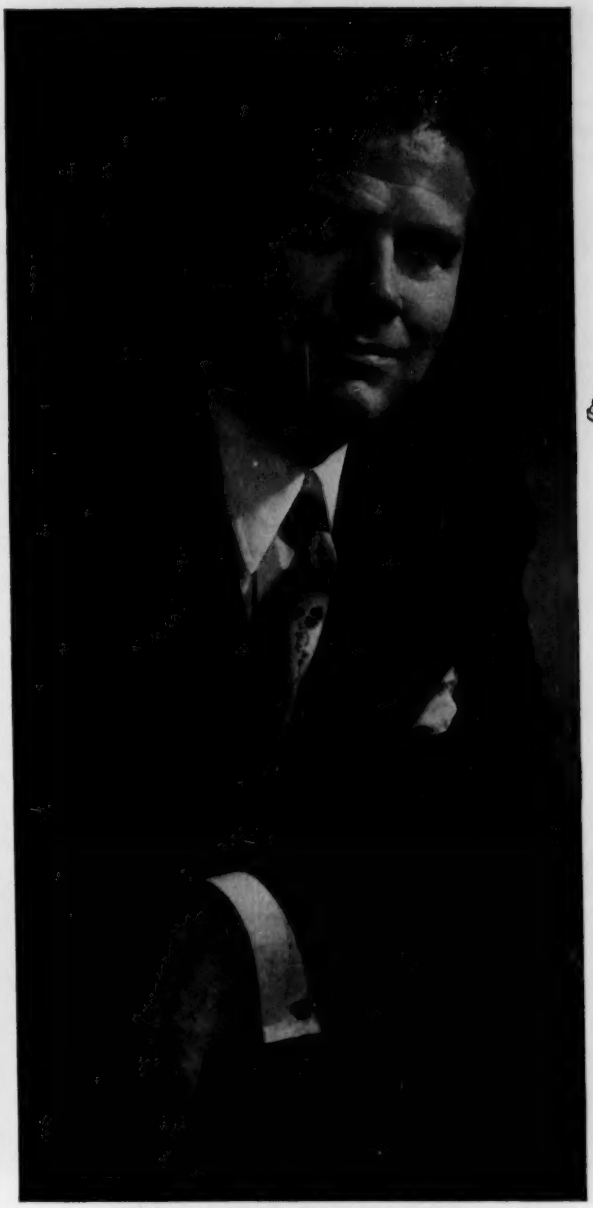
Screw will reverse to eject coal obstructions

in matched sections and can be assembled to operate at any angle, with single or dual discharge chutes. Conveyors can also be specified for horizontal cross-feed tandem or vertical operation.

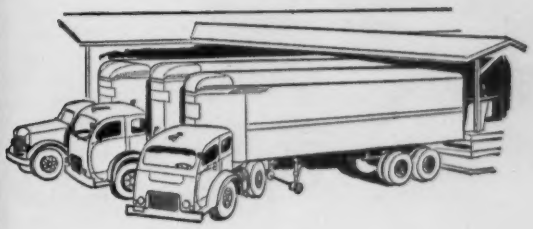
Coal screws are completely free-floating, and power units are totally enclosed oil-bath type.

Standard capacity is 2500 lb/hr based on 48-lb coal. Larger capacities are available on specification.

(Self-clearing coal conveyor is manufactured by The Will-Burt Company, Orrville, Ohio.) Circle 9038 inside back cover.



Roy Fruehauf, President, Fruehauf Trailer Company



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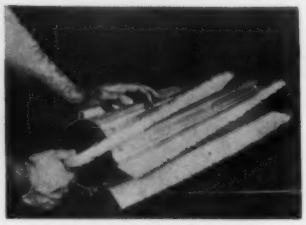
Circle 9039 inside back cover.

Cleans conveyor belt, plastic brush has rugged bristles

Designed for cleaning carry-back from conveyor belting, low cost efficient brush employs an extruded aluminum mounting along with a synthetic fill material.

Called Korfil "P", the synthetic material has inherent qualities that provide fast, thorough cleaning action, and considerably longer wear life than any other synthetic.



Power brush uses rugged synthetic fill material

Suited to both high and low temperatures, the brush will not absorb moisture and is not harmed by acids or alkalis.

The brush has a built-in self-cleaning feature through its use of individual strip brush inserts. Consequently, its unique brushing action permits brush to remove 80 to 100 percent of carry-back.

In addition, cleaning the snubber pulley and return idlers is reduced to a minimum by the application of the brush.

The extruded aluminum mounting securely holds the individual strip brushes. This mounting is reusable thus permitting on-the-job replacement of the strip brushes which reduces over-all cost. Hard rubber end bushings are used to support the mounting on shaft.

To be effective, power brush should be located on the bottom side of header roll. This location is ideal because belt is flat at this point, and header roll supports belt so that the brush can do an effective job.

When possible, the header pulley can be used to drive the brush. However, when a separate drive is used, the wiring should be connected so that the brush drive will start and stop with the belt drive.

To assure uniform brushing pressure an ammeter can be installed in the drive motor circuit and a no-load reading taken. After the brush is brought into proper position a load reading can be taken and this establishes the proper brushing pressure adjustment reading on the ammeter.

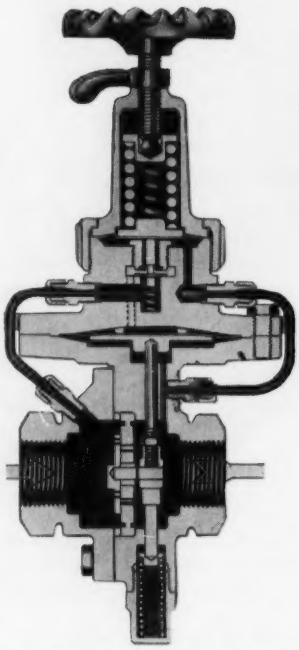
Brush comes in three fill sizes — .040", .028", and .016".

These units have three brush face sizes of 16", 18" and 24" and can be combined to clean any belt size.

(Roto-Master power brush is a product of The Osborn Manufacturing Co., Dept. P&PSE, Cleveland, Ohio.)
Circle 9040 inside back cover.

Pressure regulator for 250 psi and 450°F

Redesigned series of piloted pressure regulators provide minimum maintenance, tight shut-off, and more accurate regulation.



Regulators feature Teflon pilot seat

Features include patented sliding gate and plate seats and new external sensing tubes, Teflon pilot seat and handwheel and thumblock, ball and ball bearing adjustment.

Suitable for pressures to 250 psi wsp and temperatures to 450°F, units are available in ½ inch to 2" sizes from stock in bronze, cast iron and ductile iron with screwed ends.

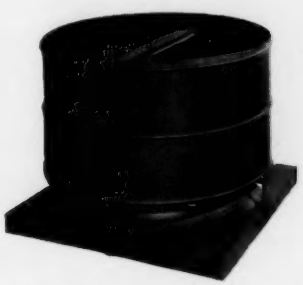
Regulators are designed for steam, water, oil, gas and chemicals.

(Piloted pressure regulator is product of OPW-Jordan Corp., Dept. P&PSE, 6013 Wiehe Road, Cincinnati 13, Ohio.)
Circle 9041 inside back cover.

Propeller roof ventilator has up-blast exhaust

Containing 16 models, line of propeller roof ventilators feature high-speed, high-air capacity for up-blast exhaust ventilation in industrial applications.

Units mount directly over roof opening for exhaust from duct or open area. It has a totally enclosed, permanently lubricated, ball-bearing motor; together with butterfly damper and steel propeller of airfoil design.



Ventilator's propeller blades can be individually replaced

Propeller blades can be individually replaced.

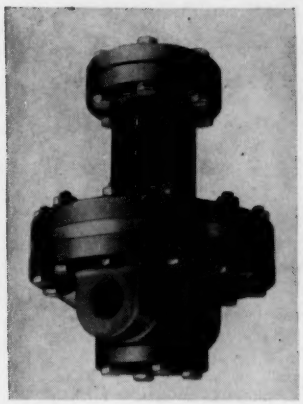
Steel housing and weathertight welded frame have aluminum finish over rust-resisting primer.

(Type UB Propeller Roof Ventilators are products of Ilg Electric Ventilating Co., Dept. P&PSE, 2850 Pulaski Rd., Chicago 41, Ill.)
Circle 9042 inside back cover.

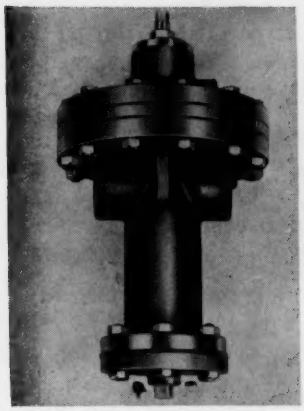
Controls atomizing steam pressure

Two differential pressure regulators have been designed for controlling atomizing steam pressure at values higher or lower than fuel oil pressure — one regulator for each job.

The first, the Atlas Fig. 1200, Type C, controls atomizing steam pressure at an adjusted value higher than fuel oil pressure. The other, the Atlas Fig. 1210, Type C, controls atomizing steam pressure at an adjusted value lower than the fuel oil pressure.



This regulator controls atomizing steam at an adjusted value higher than fuel oil pressure



This regulator controls atomizing steam at an adjusted value lower than fuel oil pressure

Simple in design, both valves are available in sizes ½" to 2" inclusive. Easy to service and install, they have a minimum number of moving parts and require no internal adjustments.

Of shear port design with honed guide, both valves have telltale ports which indicate rupture of either steam or oil diaphragm. O-ring seals are suitable for 400°F.

Their range of differential pressure adjustment is 5 to 45 psi.

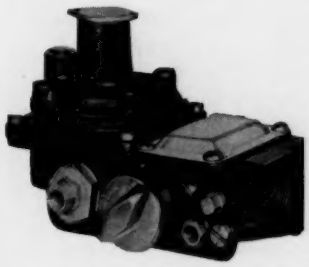
(Atlas Fig. 1200, Type C regulator is a product of the Atlas Valve Co., P&PSE, 280 South St., Newark 5, N.J.)
Circle 9043 inside back cover.

(Atlas Fig. 1210, Type C, regulator is product of Atlas Valve Co., Dept. P&PSE, 280 South St., Newark 5, N. J.)
Circle 9044 inside back cover.

One gas control center does work of 6

A small, compact gas control center does the work of six gas controls needed in wall heaters, clothes dryers, space and unit heaters. Providing all the convenience of automatic thermostatic control at any desired temperature, the unit meets minimum space requirements.

The control can be used with all gases, even sour, and



Compact control can be used with all gases

is designed for easy field conversion to LPG without breaking pipe connections.

Built-in "A" and "B" cocks or flow interruptor, safe lighting and 100-percent safe shut-off are features.

Each unit can be converted to electrically operated thermostatic control with a complete kit, which includes a choice of two thermostats, transformer, wire and staples. In addition, a choice of non-electric automatic temperature control accessories are available.

An optional modulating snap operator is also offered.

(Series 5010 gas control is manufactured by Heating and Air Conditioning Div., Controls Company of America, Milwaukee, Wis.)
Circle 9045 inside back cover.

Foam plastic insulation has low K-factor

Specifically designed for low temperature application down to −300°F, pre-molded rigid polyurethane pipe insulating material has a K-factor of .096 Btu per sq ft, hr, °F — less than one-half that of other industrial insulation suitable for low temperature use.

Formed of a mass of closed cells containing entrapped inert gas, insulation has low permeability, is non-capillary and dimensionally stable. It is used to insulate lines in continuous service between −300° F and +250°F. For intermittent service its upper temperature range will extend to +275°F.

Because of its low K-factor, substantially reduced thicknesses give the same thermal protection. It does not require special installation tools or materials. Light-weight, easily handled and simply cut with a knife, it is non-irritating, non-abrasive and non-toxic.

With a density of three pounds per cubic foot, it has a compressive strength of 50 psi at 75°F, a flexural strength of 103 psi and a tensile strength of 60 psi.

The pre-molded insulation is currently available in all standard IPS sizes from ½ in to 12 inch diameter. Additional sizes will be available soon. Thicknesses range from ¾ inch to 2½ inch at ½ inch increments, and molded pipe half-sections are three feet long.

(B-H Rigid Foam insulation is manufactured by Baldwin-Hill Co., Dept. P&PSE, 500 Breunig Ave., Trenton, N. J.)
Circle 9046 inside back cover.

Outstanding Accuracy

PALMER

Dial Thermometer

Check these functional features

- Direct-drive Bourdon Coil with a filled system for longer lasting accuracy.
- Stem can be placed at any desired angle and case can be rotated to most readable position.
- External calibration for zero setting.
- Unaffected by stem alignment.
- Accurate to one scale division.
- No sticking at any temperature.
- Non-corrosive case.

PALMER

THERMOMETERS, INC.

Mfrs. of Industrial Laboratory, Recording and Dial Thermometers

2515 Norwood Ave., Cincinnati 12, O.

Circle 9047 inside back cover.

AIRETOOL

Cleans plant air

Developed for industrial operations where the volume of air is unusually high, unit receives plant air, recovers nearly 100% of the dust load, dissipates harmful fumes, and recirculates air that has been thoroughly cleaned.

Filter unit handles large volumes of air

Unit consists of heavy gauge steel housing, hopper, 80 cloth filter tubes, and a shaker mechanism. Accumulated dust is automatically shaken from the tubes into the hopper at the end of each fan operation.

Depending on plant requirements, the filter may consist of single or multiple units. One shaker serves two units. No matter how large the installation, only one air inlet and one air outlet are needed.

Easy access for tube installation and inspection are provided by a large door.

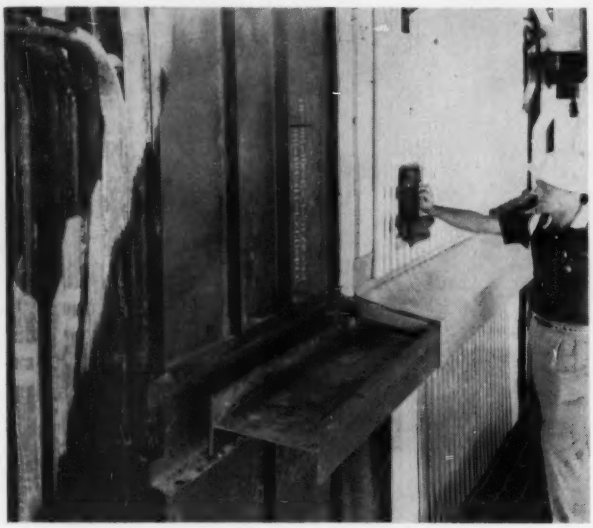
(Dustkop Filterkop is product of Aget Manufacturing Co., Dept. P&PSE, Adrian, Michigan.)
Circle 9048 inside back cover.

Teflon-coated cups for hydraulic, pneumatic use

In hydraulic and pneumatic equipment, Teflon-coated cups reduce the breakaway torque required to operate cylinders, reduce running friction, will not stick to cylinder walls even after prolonged periods of idleness, and eliminate packing chatter and squealing.

By perfecting a technique which overcomes Teflon's anti-sticking qualities, the manufacturer has increased its effectiveness as a coating on packing. A thin layer of Teflon coating becomes an integral part of the packing.

(Teflon-coated cups are manufactured by The Garlock Packing Company, 430 Main St., Palmyra, New York.)
Circle 9049 inside back cover.



Aluminum lagging for boilers . . .

. . . can be easily and inexpensively installed through a technique devised by the Stearns-Roger Manufacturing Co., Denver, Colo.

Technique involves the use of Nelson arc-welded studs and aluminum insulation straps.

In brief, the arc-welded studs are installed on the steel inner pressure casing of the boiler. Block-type insulation is then impaled on the stud, and aluminum insulation straps impaled over the installation. A speed clip is used to secure strap insulation to casing. Final step in application of lagging involves impaling the sheet on the stud and fastening entire assembly with the standard aluminum caps supplied with the stud.

Advantages over conventional methods are that no special tools are needed, and that one stud provides adequate anchorage for the complete insulation-lagging assembly.

Another advantage is the ease with which both the insulation and lagging may be removed intact to permit repair or replacement of boiler tubes. Most of the material is suitable for reinstallation after removal.

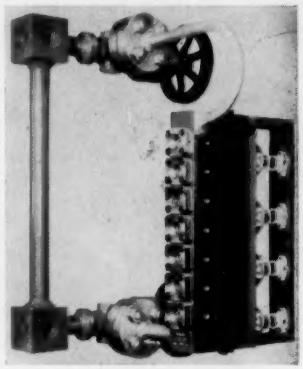
Other advantages include: good appearance; no need of paint; lighter weight, thereby reducing problem of supporting lagging; and better insulating and heat transfer properties which reduce operating skin temperatures on outside of boiler.

(More information on installation of aluminum lagging may be obtained from Aluminum Company of America, Dept. P&PSE, 1501 Alcoa Bldg., Pittsburgh 19, Pa.)

Check 9050 on Reader Service Card.

Shows boiler water level in easy-to-see color, up to 1050 psi

For boilers operating at pressures up to 1050 psi WSP, water level gage gives brilliant two-color readings — steam shows red; water shows green. A full gage is all green and an empty gage is all red.



Steam shows red, water shows green in level gage

This gage has been designed specifically for boiler applications in the medium pressure field. The design is the individual port type, with cover plate assemblies that can be serviced or replaced in a matter of minutes with the gage in place.

Exclusive spring loading maintains proper pressure on sealing gasket at all times. Port assemblies are completely interchangeable.

Ranges of visibility available are 13", 15½" and 18". Illuminators give greatest intensity of light in the middle of each port.

(Medium-pressure color-port gage is manufactured by Yarnall-Waring Company, 100 Mermaid Lane, Philadelphia, Pennsylvania.)
Circle 9051 inside back cover.

It's hard to fool this flame detector

Using a different principle in flame detection, universal detection device will not measure visible radiation from other sources in all types of commercial and industrial

heating or processing burners.

Heart of this system is a recently unveiled ultraviolet-sensitive tube that makes possible practical use of invisible ultraviolet rays in flame-detection application.

The tube works with an amplifier circuit to add up the impulses of electrical energy generated by the tube as it counts the ultraviolet rays present in all types of flame.

An output of two microamps from the tube is necessary to prove the flame radiation circuit and indicate a minimum satisfactory flame condition to assure safe burner operation.

Since all types of flame emit light in the ultraviolet spectrum, it is possible to use the system with all fuels including gas-oil combinations, and on both single and multiple burners. Since it responds only to ultraviolet light, it is not affected by hot refractories, incandescent light, hot metal parts or any flickering radiation in the visible or infrared regions.

System has an ambient temperature rating of 50° to 135°F but can be used to sight temperatures up to 2200°F without any back light effect.

Models are available permitting operation on 120, 208 or 240v, 50/60 cycles. For use on 25 cycles, a frequency doubler allows the unit to be operated on 50 cycles.

(C7012A UltraVision Flame Detector is manufactured by Minneapolis-Honeywell, 2747 Fourth Ave., South, Minneapolis 8, Minn.)
Circle 9052 inside back cover.

Portable and bench units for preventative maint. of electrical equipment

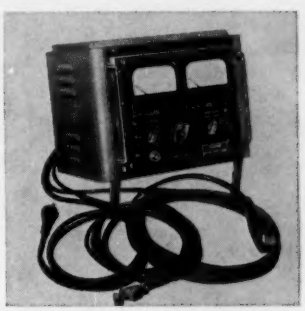
For step-voltage resistance tests, voltage withstand, breakdown, and 1-min resistance tests on insulation in electrical equipment with voltage ratings in the 300, 600, and 2500v classes, portable and bench models of dielectric test set are rated at 5 kv and 1 ma.

Equipment is designed for use with rotating electrical machinery, dry-type transformers, switchgears, capacitors and insulators rated 230, 440, 550 and 2500v AC and DC, traction motors and generators.

Both portable . . .

Bench model is ideal for making acceptance and proof test on electrical insulating systems for purposes of quality control in manufacturing and repair.

Portable set — housed in a shock and wear resistant case — lends itself to severe field use for test of reconditioned equipment after installation and in preventive maintenance of installed electrical equipment.



. . . and bench models of dielectric test set for testing electrical insulating systems

Both units have separate meters for measuring output current in voltage and separate terminal for connecting external instruments for measuring output and detecting corona.

They are completely guarded, including output cable, so that output current as low as 1 ma can be measured at maximum output voltage even in humid ambient atmosphere.

Full-wave dry-type rectifier insures long maintenance-free service. All connection cables are attached to terminals of the test set circuit inside its housing and stored in a compartment of the case, always ready for use.

Sets weigh around 26 lb.

(Dielectric Test Sets are products of James G. Biddle Co., Dept. P&PSE, 1316 Arch St., Philadelphia 7, Pa.)
Circle 9053 inside back cover.

Magnetic clutch is almost maintenance free

Stationary-field magnetic clutch design virtually eliminates need for maintenance in machine transmissions.

Clutches also permit reductions in size of machine tool transmissions by providing more torque for their size.

They can be buried in machine drive box or transmission. No air gap adjustments need to be made, no slip rings and brushes need to be cleaned, adjusted or replaced.

Use of a closed flux path through hardened steel laminations, eliminates need for adjusting air gaps. Stationary magnetic field eliminates slip rings and brushes.

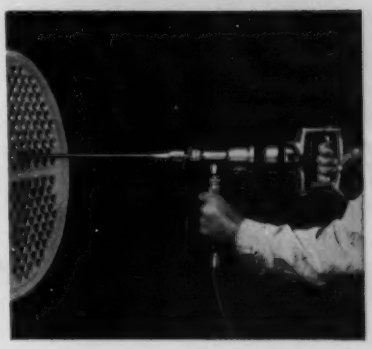
Primary advantage of clutch is single-unit construction. Simplifying machine assembly, it permits fast installation. Stationary portion of the clutch is secured from rotation by a single threaded rod which screws into a tapped hole in the magnet body.

Applications include machines for washing, pulverizing, printing, packaging and strapping, and more specialized equipment such as conveyors, welders, wind tunnels, nuclear control mechanisms, radar antennas, test equipment and steel rolling mills.

Clutch series includes five sizes with torque ratings from 14 through 290 pound-feet.

(Magnetic clutch is manufactured by I-T-E Circuit Breaker Co., Dept. P&PSE, 1900 Hamilton St., Philadelphia 30, Pennsylvania.)
Circle 9054 inside back cover.

AIRETOOL CLEANER



cleans condenser, H. E. tubes fast

This new, advanced design Airetool Model CC-475 Cleaner does a fast, thorough job of cleaning heat exchanger and condenser tubes. Built-in flushing system washes out debris, stops jamming. The result is faster, more complete cleaning. And the flushing agent keeps the cleaning head cool, which extends head life.

You get all these advantages, yet this sturdy, pneumatic tool weighs only 10 pounds. One man operates it easily without need for supporting rig. For full details, or plant demonstration, write today.

USES ALL TYPES OF HEADS

Every type of cleaning head can be used with Airetool Model CC-475. And Airetool makes them all.

BRANCH OFFICES:
New York, Chicago, Tulsa, Philadelphia, Houston, Baton Rouge

REPRESENTATIVES
In principal cities of U.S.A., Canada, Mexico, South America, England, Europe, Puerto Rico, Italy, Japan, Hawaii.

EUROPEAN PLANT: Vlaardingen, The Netherlands

CANADIAN PLANT: Brantford, Ontario

Circle 9055 inside back cover.

INSULATED WIRE

Area light fixture has broad light pattern

Broad, even light pattern of area light will illuminate up to three times as wide an area as incandescent floodlights of comparable wattage. Horizontal beam spread at 50 percent of center candlepower is 138°.

Area light fixture gives long lamp life

The reflector is segmented for compound curvature which captures and utilizes maximum output of the lamp. Reflector may be easily replaced if damaged.

Heavy-duty cast aluminum body is dust-proof and is coated with epoxy-base aluminum paint for corrosion control. Special access plate permits easy relamping without disturbing the seal of the tempered, shock-resistant lens.

Designed especially for use with color-corrected mercury vapor lamps, fixtures are used for local lighting in industrial plants, loading docks, service stations and for all types of protective lighting.

Models are for use with 100, 175, or 250-watt color-corrected mercury vapor lamps, and 200-watt incandescent lamps. They are available with or without integrally-mounted ballasts.

(Area light fixtures are manufactured by Wide-Lite Corporation, Dept. P&PSE, Houston, Texas.)
Circle 9056 inside back cover.

Packaged HTHW boiler has high efficiency

For coal, gas, or, oil

Specifically designed for high temperature hot water heating and process work, packaged boiler has high efficiency and covers wide range of load requirements.

Water is circulated at temperatures between 250°F and 450°F with system loads from 4 to 100 million Btu/hr.

Circuits are arranged to eliminate the possibility of vapor locking as there are no reverse vertical down flow tube circuits. All circuits are drainable at one point through the bottom header, and vented at one point through the top header.

Correct sizing of the orifice in the inlet end of each tube maintains the required velocity of water in each tube circuit. Metered flow assures sufficient water to absorb the maximum amount of heat that will contact surface of each circuit.

Boiler is entirely supported on structural steel frame and enclosed with a welded steel casing designed gas-tight for pressurized furnace firing. No special foundation or brick supporting construction is required.

Nitrogen pressurized or steam balanced expansion drum maintains necessary pressurization on the system. The water level in the drum rises and lowers as the return water temperature changes.

System make-up water is only a fraction of one percent. Softener and deaerating heater, if used, will need units with only 1/20th the capacity ordinarily required for treatment of a steam system of similar size, using the same analysis of make-up water.

Boiler is designed for firing with oil, gas, combination oil/gas, or stoker for coal firing.

(Packaged water boiler is manufactured by Boiler Engineering & Supply Co., Inc., Dept. P&PSE, Phoenixville, Pennsylvania.)
Circle 9057 inside back cover.

Double-acting air cylinders can be mounted five ways

Line of square-end double-acting air cylinders consists of basic cylinder which accommodates five interchangeable mountings simplify installation.

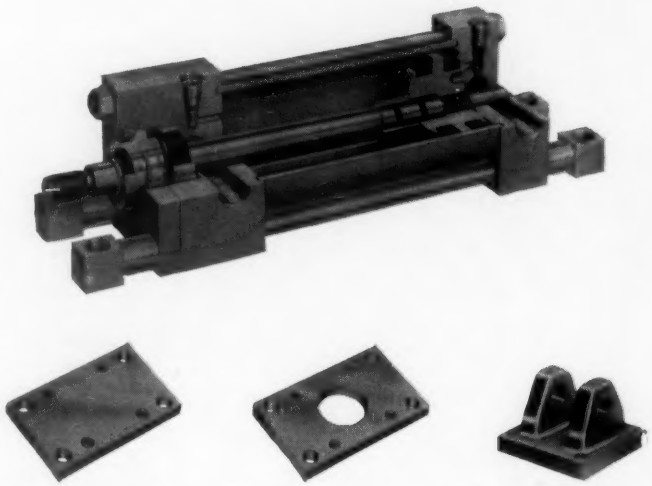
For applications requiring piston motion parallel to the mounting surface for rigid, straight-line power delivery, the leg mount is ideal. The "base" or "flush mount" is for applications requiring a push-pull power stroke that is perpendicular to the mounting surface. The "side flush mount" is used where space requirements are at a premium.

A one-bolt mounting feature is ideal for any application requiring a pivoting motion of the cylinder. Flush mounting allows for attachment on any flat surface where it is desirable to have the piston rod extend through the mounting surface to deliver push-pull force.

Available in five sizes up to 4-inch bore, cylinders are designed for air pressure to 250 psi or hydraulic pressures to 750 psi.

Each size is obtainable with or without adjustable cushion. Square-end design and interchangeable mounting plates permit mounting in either parallel or 90° position relative to ports.

Design features include: cartridge-type bronze bearing with self-adjusting "U" cup piston rod seal; ground, hard chrome-plated piston rods with minimum yield strength of 125,000 psi; all-machined cylinder ends and mounting plates; and high tensile strength tie rods with 87,000-107,000 psi yield point.



Five mountings for basic cylinder are available; bolt, flush, leg, base or side flush

Cushion and adjusting screws are recessed for protection, yet are easily accessible. Cushion can be locked to permit vibration-proof adjustments.

(Square-end double-acting air cylinders are manufactured by A. Schrader's Son, Division of Scovill Manufacturing Co., Dept. P&PSE, 470 Vanderbilt Ave., Brooklyn, New York.)
Circle 9058 inside back cover.

NEW LITERATURE

Reviews of books and

For Man-Cooling!

Coppus Airplane Type Heat Killer®

cools large areas — restores efficiency

HEAT KILLER on the job in drop forge plant.

Steel mills, drop forge plants, foundries and other plants with hot working conditions find this Coppus Heat Killer increases worker efficiency . . . at reasonable cost. *A single fan cools large areas.*

Other types also available for cooling furnaces, electrical equipment, for driving out gases, drying out products, drawing out fumes. Write now for detailed information. COPPUS ENGINEERING CORPORATION 186 PARK AVENUE, WORCESTER 2, MASSACHUSETTS.

ANOTHER COPPUS "BLUE RIBBON" PRODUCT

Circle 9059 inside back cover.

GOT A STEAM CORROSION PROBLEM?

You may find the solution you're looking for in a story that appears in this month's NEW SOLUTIONS section, which starts on page 24. Each month, you'll find the means by which other companies solve their plant and power services problems described in this highly informative section.

NEW DEVELOPMENTS

Circuit breaker is solenoid-operated

Remote, solenoid-operated circuit breaker, electrically operated and mechanically held, is designed for use with variety of automatic controls for multiple-circuit, mixed-load service. Capacities are 0-50a and 50-100a at 240v, 480v and 600v AC, 125 and 250v DC, with interrupting capacities rated up to 10,000 amp rms.

Occupying the area of two average size circuit breakers, compact unit can be used for variety of services including remote-operated breaker, limited-duty motor starter, remote, automatic lighting controls (all loads), remote control main service switch, automatic industrial battery charger cutoff, and heavy-duty contactor.

Unit can be provided for either automatic or manual reset when breaker is tripped.

Solenoids which open and close the breaker are available for use with all voltages, AC or DC. The switch is thrown from open to closed position by momentarily energizing the proper solenoid.

An interlocking latch and pivoting trip bar throws the breaker switch to desired position. Heavy spring tension is employed for positive trip bar "latching". The switch may be used for maintained or momentary contact, 3 wire or 2 wire.

In event of over-current or outage, an overload on any pole opens all poles so that possibility of single-phasing of polyphase motors is minimized. Silver contacts are employed for minimum resistance, and for maximum contact life.

Parallel grid plates are employed in the arc quenchers, which are arranged so that arcs are confined and extinguished in less than ½-cycles.

Remote-indicating lights can be provided to show switch position.

(Remote solenoid-operated breaker is product of Lake Shore Electric Corporation, Dept. P&PSE, 205 Willis St., Bedford, Ohio.)

Circle 9060 inside back cover.

INSULATED WIRE that will withstand **2000°F**

AEROPAK Insulated Wire long lasting eliminating costly replacements

- Available in outside diameters of .04 to .32.
- One or more wires insulated with a pure mineral swaged into a metal tube.
- Can be sharply bent.
- Sheath can be welded without loss of insulation.
- Available in many sheath-wire and insulation materials.
- Complete thermocouple probes available using this material made to your requirements. Send for Bulletin 3.8A.

For AEROPAK Ceramic Insulated Wire—Bulletin 4

Aero Research INSTRUMENT COMPANY, INC.

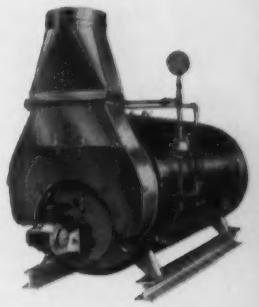
315 NO. ABERDEEN STREET, CHICAGO 7, ILLINOIS

Sales Representatives throughout the United States and Canada

Circle 9061 inside back cover.

Charles J. Kuntz, Chief Engineer at the Van Dyne-Croty Co., Dayton, Ohio, says:

"We have always considered the Leffel Boiler the best that is obtainable"



Mr. Kuntz's experience reflects our sole objective . . . to provide the best boiler that it is possible to build. That's why Leffel boilers far exceed minimum code requirements. That's why Leffel boilers are bigger, heavier and stronger than other boilers of the same capacity. That's why Leffel boilers can produce, day after day, at double their catalog rating and beyond. And that's why Leffel boilers are longer-lived, safer, and more dependable.

For complete details on Leffel boilers — gas, oil or coal-fired — for requirements from 6 to 500 HP, write today for your free copy of Bulletin 236. Compare Leffel construction with anything else on the market. The facts and figures will prove that you should buy Leffel . . . and that will be the beginning of safe, carefree, profitable boiler operation for you.

THE JAMES LEFFEL & COMPANY
Dept. I
SPRINGFIELD, OHIO

Circle 9062 inside back cover.

NEW LITERATURE

NEW LITERATURE

for effective plant and power services operation

Reviews of books and industrial bulletins describing equipment, supplies, services

Interior fire fighting — all kinds discussed

Nine major brands of fire extinguishing systems, portable extinguishers, cabinets and other inside fire control products are discussed in 28-page brochure.

Every type of modern interior fire control system — automatic sprinkler, carbon dioxide, dry chemical, foam and smoke detection — is described and illustrated.

Details on hose and extinguisher wall mounted and recessed cabinets, a review of all latest-style extinguisher models, data on hose nozzles, valves and connections, facts on hundreds of other fire control accessories are also provided.

(Form No. S-62 is available from The Fyr-Fyter Company, Customer Service Dept., Dept. P&PSE, 221 Crane St., Dayton 1, Ohio.)
Circle 9063 inside back cover.

How to cut cleaning time in wet dust collectors

Cleaning time on wet-type dust collectors has been cut from as much as 8 hrs to a bare ½ hr out of each 40 hrs of operation, according to actual case histories reported in handy volume.

These reports show how a safe, non-toxic cleaner keeps collectors operating at peak efficiency. In addition, the material prevents hard deposits from forming, neutralizes acidity, removes corrosion deposits and protects against further corrosion.

(Case History volume is available from The North American Mogul Products Company, Dept. P&PSE, Standard Building, Cleveland 13, Ohio.)
Circle 9064 inside back cover.

Controls pump recirculation

A pump recirculation control system to maintain safe, adequate pump flow at all times is described in two-page bulletin.

Both pneumatic and electric systems for increasing pump flow by recirculation are shown.

(Bulletin 560 is issued by Bailey Meter Company, Dept. P&PSE, 1050 Ivanhoe Road, Cleveland 10, Ohio.)
Circle 9065 inside back cover.

It gives complete data on hot water boiler

Curves, tables, charts and photographs amplify the explanation of a hot water heating boiler in eight-page bulletin.

Built in 18 sizes from 500,000 Btu/hr to 20,000,000 Btu/hr, the boiler has been designed specifically for forced circulation of hot water service.

The internal boiler water circulation arrangement permits the unit to withstand three times its rated capacity in terms of thermal shock.

(Bulletin 1251 is issued by Orr & Sembower, Inc., Dept. P&PSE, Reading, Pa.)
Circle 9066 inside back cover.

Describes air-operated screwdrivers

Completely new line of pneumatically operated screwdrivers and nutsetters is described in illustrated bulletin.

(Bulletin No. 68 is available from Airetool Manufacturing Company, Dept. P&PSE, 328 S. Center St., Springfield, Ohio.)
Circle 9067 inside back cover

For control panel info systems

Five accessories for use with control panel information systems are illustrated and described in four-page bulletin.

Accessories are: (1) liquid level indicators which show fluid level at remote points, (2) interlock receptacles for safe operation in hazardous places, (3) mercury pushbutton and selector switches for Class 1 Division 2 locations, (4) plug-in testers for operational testing of relays, and (5) mechanical pushbutton switches for panel mounting.

(Bulletin #104 is available from Panellit, Inc., 7401 N. Hamlin Ave., Skokie, Illinois.)
Circle 9068 inside back cover.

Submersible pumps for booster service

Applications and uses of line of horizontal in-line submersible pumps for booster service is described in illustrated bulletin.

(Bulletin No. 203 is issued by Layne & Bowler, Inc., Dept. P&PSE, Memphis 8, Tennessee.)
Circle 9069 inside back cover.

Helical gear-motors, speed reducers

Construction features and applications of helical gear-motors and speed reducer line are described in text and pictures in 16-page bulletin.

Cutaway drawings show maintenance features, and information is provided on field and factory testing help.

(Bulletin GEA-6704 is issued by General Electric Company, Dept. P&PSE, Schenectady 5, N. Y.)
Circle 9070 inside back cover.

Compact boiler in action

Package, compact water-tube boiler is the subject of a 16-page bulletin. It shows recent industrial installations of the boilers.

The story of each installation is told in a series of photographs and captions telling how heating problems in each industry were solved by single and multiple boilers, both high and low pressure systems.

(Bulletin 491 is issued by the Vapor Heating Corporation, 80 E. Jackson Blvd., Chicago 4, Ill.)
Circle 9071 inside back cover.

Index to instrument literature

Handy index to all company's literature on instruments is given in 24-page bulletin.

Types of literature listed include product catalogs, specifications, technical bulletins, industry bulletins, and instrumentation data sheets.

Also given is a subject-company index of the company's magazine "Instrumentation" covering articles presented since 1951.

(Bulletin G2-1a is available from Minneapolis-Honeywell Regulator Company, Wayne and Windrim Aves., Philadelphia 44, Pa.)
Circle 9072 inside back cover.

Remove dissolved O_2 chemically

A revised technical bulletin on the use of sodium sulfite, anhydrous technical, for removing oxygen from boiler feed water has just been released.

The bulletin describes the action of oxygen in boiler corrosion, the principle of the Santosite treatment and the operating procedures required for effective use.

("Santosite" bulletin is issued by the Monsanto Chemical Co., 800 North Lindbergh Blvd., St. Louis 24, Missouri.)
Circle 9073 inside back cover.

Reaches high places

Eight-page bulletin discusses hydraulically operated telescopic boom mounted on a 16,000-lb or heavier truck chassis.

Boom is completely maneuverable, ranging from straight-out to straight-up, and features a 270° turning radius without moving truck.

Average working height is 48 ft with all movements controlled by electrically actuated solenoid valves and double-acting hydraulic cylinders.

(Industrial Monkey bulletin is issued by Peters Company, Dept. P&PSE, 1933 South East Union Ave., Portland 14, Ore.)
Circle 9074 inside back cover.

Low-headroom hoists

Construction details, mounting option information, performance data and dimensions on a line of low headroom electric hoists is presented in 12-page bulletin.

Hoists are available in four frame sizes with capacities ranging from one-half to ten tons.

(Bulletin 920 is issued by Robbins and Myers, Inc., Hoist & Crane Division, Dept. P&PSE, Springfield, Ohio.)
Circle 9075 inside back cover.

Underfeed stoker applications

Revised, expanded edition of Guide Specifications GS-1 for underfeed stoker applications to boilers best suited for commercial and industrial heating plants (750-6000 lb/hr) contains 54 pages of text and 5 large, fold-out drawings of flexible layouts of efficient, economical equipment.

Specification criteria cover coal and ash handling, boilers and stokers.

(AIA No. 30-A is available from Bituminous Coal Institute, Dept. P&PSE, Washington, D.C.)
Circle 9076 inside back cover.

Increases finned tube surface area 13%

As a result of a redevelopment of fin contour, the surface area in an admiralty finned tube has been increased 13%. All details are given in 24-page reference catalog.

(Trufin reference catalog is issued by Wolverine Tube, Division of Calumet & Hecla, Inc., Dept. P&PSE, 17200 Southfield Rd., Allen Park, Michigan.)
Circle 9077 inside back cover.

Expansion joints

Four-page bulletin describes complete line of packless corrugated expansion joints and tells how to select them.

Every type is illustrated and explained. These include self-equalizing, duo-equalizing, non-equalizing, flexible connectors, high pressure toroidal, universal, modified universal, hinged and gimbal, pressure balanced and pressure balanced universal expansion joints.

(Expansion joint bulletin is available from Zallea Brothers, Dept. P&PSE, 815 Locust Street, Wilmington 99, Del.)
Circle 9078 inside back cover.

Heat transfer units don't use coils

Eight-page bulletin on a "Multi-Zone Platecoil" heat transfer unit illustrates and discusses construction and application advantages in tank and process heating and cooling, heat recovery, and ovens and furnaces.

Table for converting lineal feet of pipe coil to square feet of "Platecoil" simplifies calculation of requirements.

Units are applicable for pressures to 250 psi steam, and configuration provides better steam distribution with less condensate trapping.

(Bulletin PD-1 is issued by "Platecoil" Division, Tranter Manufacturing, inc., Dept. P&PSE, Lansing 9, Mich.)
Circle 9079 inside back cover.

High-torque transmissions and speed reducers

Transmissions and reduction gears with input torque capacities ranging from 120 to 2400 ft-lb are subjects of 32-page engineering data booklet.

The illustrated reference book gives such information as: detailed engineering drawings of 15 transmissions and reduction gears; complete specifications, including capacity and gear ratios; and variations available for all standard units.

(Transmission and speed reduction bulletin is available from Cotta Transmission Co., Dept. P&PSE, 2340 11th St., Rockford, Ill.)
Circle 9080 inside back cover.

Level indicators, controls

Four-page bulletin describes complete line of liquid level indicators and controls.

Discussed in the bulletin are industrial liquid level indicators, fuel oil indicators, dial indicators, truck tank indicators, specific gravity indicators, manifold valves, and liquid level controls.

(Bulletin A is issued by Petrometer Corporation, Dept. P&PSE, 43-22 Tenth St., Long Island City 1, N. Y.)
Circle 9081 inside back cover.

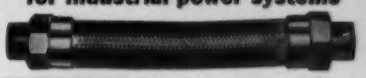
Heavy-duty air motor information given

Twelve models of heavy-duty air motors, ranging from 11½ to 20 hp with output shaft speeds from 19 to 800 rpm, are described in bulletin.

Direct-drive models with standard flange, NEMA D flange or foot mountings, and geared-drive models with foot mountings are shown.

(Air motor bulletin is issued by Joy Manufacturing Company, Dept. P&PSE, Oliver Building, Pittsburgh 22, Pennsylvania.)
Circle 9082 inside back cover.

Custom constructed assemblies for industrial power systems



All sizes in bronze, stainless or carbon steel, monel, inconel and low carbon nickel. Seamless spiral or parallel corrugation... Braided. All type of fittings and flanges welded, brazed or soldered. Also, interlocked hose.

write — wire — phone: RE 7-3311
...for prices and catalogs

COBRA METAL HOSE

5039 S. Kedzie Ave. • Chicago 32, Ill.

Circle 9083 inside back cover.

LOOKING FOR AIR CYLINDERS

- Read about the latest development in double-acting air cylinders.
- This story is in the New Developments section which starts on page 28.
- You'll find descriptions of many other types of plant and power services equipment there, too.

Something new in
LINK-BELT

Plant Power Services

Brushless AC generators

Complete line of brushless revolving field alternators is described in 16-page bulletin.

Wearing parts such as commutator, slip rings, and brushes which require periodic maintenance have been replaced with non-wearing components.

Ratings of three-phase machines extend from 5 through 400 kw, and single-phase from 5 through 150 kw in both 50 and 60 cycle frequencies—400 cycle and other frequencies are also available.

(Bulletin ACG 958 is issued by Kato Engineering Co., Mankato, Minn.)
Circle 9084 inside back cover.

Corrosion resistant coatings — which to use

Bulletin tells which protective coating to use for steel, concrete and wood where corrosive spillage, fumes and atmospheres are involved. It also discusses tank linings.

Text shows type and details of wide range of protective coating for corrosive conditions and lists technical bulletins covering specific applications.

(Bulletin 259 is issued by Wisconsin Protective Coating Corp., Dept. P&PSE, Green Bay, Wis.)
Circle 9085 inside back cover.

Mercury manometer specs

Specification sheet describes mercury manometer which opens or closes successive electrical contacts with incremental changes in pressure of either a pneumatic signal or water.

Operating ranges, ratings, materials of construction, typical wiring, outline dimensions are included.

(Specification Sheet 13D1425 is issued by Fischer & Porter Company, Dept. P&PSE, 94 Jacksonville Rd., Hatboro, Pennsylvania.)
Circle 9086 inside back cover.

Describes flight conveyor for coal handling

Two-page data sheet explains fully enclosed and preassembled flight conveyor for coal handling.

Built in standardized sections, various combinations of prefabricated sections are adaptable to any length, profile or type of coal handling service.

(Coal conveyor data sheet is available from The Daniels Company, Dept. P&PSE, 22 N. Fifth St., Indiana, Pa.)
Circle 9087 inside back cover.

Discusses aluminum use in heat exchanger

Advantages of aluminum usage in heat-exchanger fabrication are fully described in 16-page publication.

Text covers aluminum heat transfer rates, temperature properties, tensile strengths, pressures and dimensional tolerances. Charts provide fingertip information on aluminum stress values, working pressures, thermal expansion, and conductivity and friction factors.

("Reynolds Aluminum for Heat Exchangers" is available from Reynolds Metals Company, Dept. PRD-2, Box 2346, Richmond, Va.)
Circle 9088 inside back cover.

"Desurgers? . . . What are they?"

Liquid level control pilot

A liquid level control pilot with an adjustable proportional band is the subject of a six-page, two-color bulletin.

By means of a single knob adjustment, proportional band can be quickly set while the liquid level system is in operation without affecting the liquid level set point.

Bulletin offers complete data on the design and construction features of the pilot as well as tables, diagrams and charts covering its operation specifications and applications.

(Bulletin 583 is available from the Leslie Co., 222 Delafield Ave., Lyndhurst, N. J.)
Circle 9089 inside back cover.

All about pumps

Five equipment bulletins have been bound into a single catalog entitled, "Pumps for Hot or Cold Corrosive Slurry Service."

Containing twenty-two pages, catalog presents line and wash drawings, photographs, specification and performance data, and parts list on three different designs — alloy metal centrifugal, line centrifugal, and diaphragm slurry pump.

(D-O pump catalog is issued by Dorr-Oliver Incorporated, Dept. P&PSE, Stamford, Conn.)
Circle 9090 inside back cover.

Explains epoxy resin aluminum cement

For filling seams, caulking, bonding, repairing pattern defects and as a seal where constant, heavy vibration is involved, epoxy resin aluminum cement comes in tubes.

Four-page bulletin fully describes material and features many application illustrations.

(Metalset bulletin is issued by Smooth-On Manufacturing Company, 572 Communipaw Ave., Jersey City, N.J.)
Circle 9091 inside back cover.

Tells nuclear power work

Company's activities in the nuclear field, ranging from design and erection of complete reactors to solution of design parameter problems, are summarized in 28-page booklet.

(Bulletin AEB-8 is issued by Atomic Energy Division, The Babcock & Wilcox Company, Dept. P&PSE, 161 East 42nd St., New York 17, N.Y.)
Circle 9092 inside back cover.

How silicones reduce insulator flashovers

How silicones reduce insulator flashovers is the subject of six-page foldout.

Brochure describes how compound curtails arcs, shorts, and the formation of leakage paths on insulators exposed to contaminated atmospheres.

The compound is easy to apply and reduces cleaning time and costs. It can be removed without use of solvents or abrasives.

The time intervals between cleanings are increased because of the longer-lasting protection.

(Brochure Code 4-215 is issued by the Dow Corning Corporation, Midland, Mich.)
Circle 9093 inside back cover.

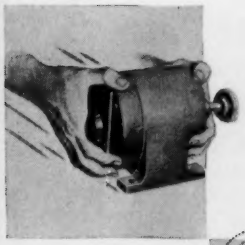
Low-cost speed control in large machines

Construction and operating features of integral shaft sheaves for low-cost stepless speed control in large machine drives are given in six-page, fold-out bulletin.

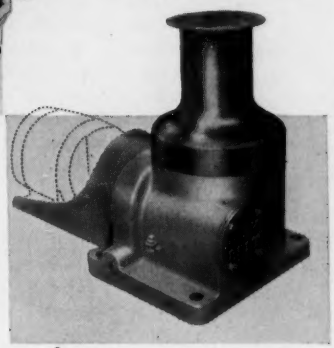
The integral-shaft design permits mounting the sheave between two pillow blocks for rigid support and flexibility.

Bulletin describes how integral-shaft sheaves are available with lubrication systems designed and engineered to distribute lubricants to all moving parts.

(Bulletin 20B7897B is issued by Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin.)
Circle 9094 inside back cover.



Something new in
LINK-BELT car spotters



Bracket mount accepts foot-mounted, hoist type motors of any manufacture

Here's a great time-saving improvement in car spotters. Link-Belt bracket mount speeds and simplifies motor replacement. Any manufacturer's motor can be used, can be switched in minutes. And there's no re-alignment problem because the bracket assures accurate positioning.

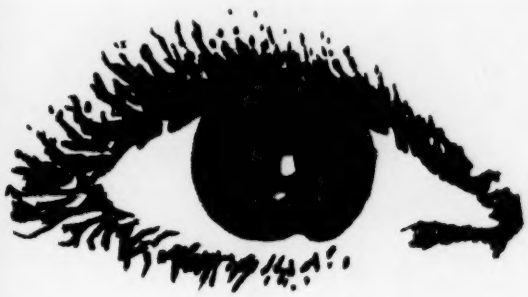
Link-Belt car spotters are available in 5 and 10 hp sizes . . . put up to 10,000 lbs. of starting rope pull in one man's hands. That's enough to move six loaded freight cars . . . quickly, easily, safely. A full range of accessories is also available.

LINK-BELT
CAR SPOTTERS AND CAR PULLERS

SEND TODAY for complete data on car spotters and pullers.

LINK-BELT COMPANY, Prudential Plaza, Chicago 1, Ill. 14,035-R

Circle 9095 inside back cover.



LOOKING FOR INSULATION?

Read about the latest development in insulation. This story is in the NEW DEVELOPMENT section which starts on page 28. You'll find descriptions of many other types of plant and power services equipment there, too.

CUT HERE AND FILE

Plant Power Services Engineer

nomograph 24

flow measurements with weirs

J. BRONSON BAYLISS
Asheville, N.C.

Part 1 – Rectangular Weirs

A rectangular weir is a simple and inexpensive flow measuring device. Although it is limited to flow in open channels, it is well suited to measurement of waste streams or to any type of surface stream.

Since it is economical to construct and install, it is often used for temporary measurements.

Flow of water through a sharp-edged, rectangular weir can be described by the Francis formula[1]:

$$q = 3.33(L - 0.2H)H^{1.5}$$

where

q = rate of flow, cu ft/sec
L = length of weir crest (horizontal width of rectangular notch), ft
H = head of water measured from weir crest, ft

Although the weir itself is simple, this empirical equation is rather unwieldy. It is well adapted to convenient calculation by nomograph. Figure 1 yields flow in gpm when one aligns weir size in inches and head of water, also in inches.

LITERATURE CITED

1) PERRY, J.H., "Chemical Engineers' Handbook" p 408, 3rd ed, McGraw-Hill Book Co., Inc., New York (1950).

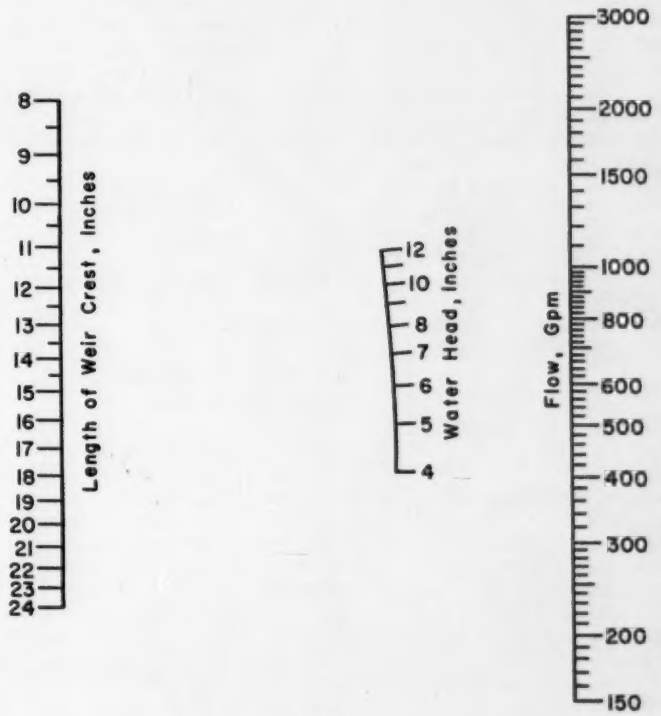


Fig. 1

Nomograph for flow measurements with triangular weir is on page 43

Tells which thermowell material to use

Four-page bulletin acts as a guide for selecting thermowell material for over 325 different temperature measuring applications.

Applications are grouped in chart-form according to industry. Recommendations include one or more materials for each application and take into consideration such factors as temperature, contamination, electrolysis, catalytic reaction, and solution concentration.

Chart is suitable for wall-mounting.

(Thermowell material guide is issued by Thermo Electric Co., Inc., Saddle Brook, N.J.)
Circle 9096 inside back cover.

Many thermocouple cables in one

Polyvinyl-insulated, multi-conductor cable for installing 6 to 56 pairs of thermocouple loads at one time is described and illustrated in four-page catalog.

Containing information on construction, ISA color coding and calibration symbols, and specifications in chart form, the catalog also presents resistance tables for pyrometer wires and an electrical properties chart of thermocouple conductor materials.

(Catalog 33 is issued by Thermo Electric Co., Inc., Dept. P&PSE, Saddle Brook, N. J.)
Circle 9097 inside back cover.

Records Btu changes

Product specification sheet contains full information and specifications on Btu meter, used to continuously record, indicate and integrate Btu loss or gain of a flowing liquid.

At the same time, temperature differential and flow rate of liquid are recorded.

(Publication 58-B913 is issued by The Hays Corporation, Dept. P&PSE, Michigan City, Ind.)
Circle 9098 inside back cover.

Pushbutton actuator fits variety of switches

Series of pushbutton actuators for use with a wide variety of basic switches is introduced in two-page data sheet.

Series includes ½-inch and 1-inch button sizes available in red, green, or black plastic.

(Data Sheet 155 is issued by Micro Switch, a division of Minneapolis-Honeywell Regulator Company, Dept. P&PSE, Freeport, Ill.)
Circle 9099 inside back cover.

Industrial incinerators

Two-color folder illustrates and describes on complete line of stationary and portable heavy-duty incinerators for industrial locations.

Complete specifications are given for wide range of standard sizes, as well as for custom-built units.

The four-page folder also covers pre-fab chimneys and other optional equipment, including a "Water Wash" for further removal of fly ash and smoke which is used in conjunction with an automatic door lock.

(AIA File No. 35-J-41 is issued by Winnen Incinerator Co., 932 Broadway, Bedford, Ohio.)
Circle 9100 inside back cover.

All about maintenance, safety equipment

Detailed information for selecting, ordering 100 different products including metal-working saws, rotary files and burs, test instruments, safety equipment and many electrical and maintenance items is given in 58-page catalog.

Dimensional drawings and how-to-use-it photographs make the catalog a useful and ready-reference buying guide.

(Catalog #32 is available from Martindale Electric Co., Dept. P&PSE, 1312 Hird Ave., Cleveland 7, Ohio.)
Circle 9101 inside back cover.

Industrial belting has nylon core

All the salient facts about type of flat transmission belting having a nylon core are given in 12-page booklet.

Subject matter includes a description of how nylon core is made and the reasons for its growing popularity, including: higher running speeds, more compact drives, ability to withstand shock loads, use with narrower belts and pulleys, freedom from excessive bearing loads, non-slip leather surface, measurable elastic quality and easy application.

(Nylon Core Belting booklet is issued by L. H. Shingle Company, Dept. P&PSE, Camden 3, New Jersey.)
Circle 9102 inside back cover.

Bearing units

Complete details of construction, dimensional tables and listing of stock sizes of line of ball bearings, pillow and flange blocks are given in 16-page bulletin.

Several pages are devoted to anti-friction bearings with unbreakable, malleable housing and welded steel take-up frames with cadmium-plated adjusting screws.

(BU-101-B catalog is issued by Browning Manufacturing Company, Dept. P&PSE, Maysville, Ky.)
Circle 9103 inside back cover.

Natural gas purifiers

Line of purifiers, scrubbers, mist extractors and separators for natural gas are described in four-page bulletin containing detail drawings, size data, applications and photographs.

Four principal liquid and dust type scrubbers are catalogued.

(Bulletin 601 is issued by The V. D. Anderson, division of International Basic Economy Corporation, Dept. P&PSE, 1935 West 96th St., Cleveland 2, Ohio.)
Circle 9104 inside back cover.

Electronic air cleaner

Describing line of high-velocity electronic air cleaners, 16-page bulletin explains the electronic principle of operation, describes collector cell construction and gives details on basic design features.

The filter is shallower, smaller in face area, requires less space than similar high velocity precipitators. Capacities range from 1000 to 240,000 cfm.

(Bulletin No. 258A is issued by American Air Filter Company, Dept. P&PSE, 215 Central Ave., Louisville 8, Ky.)
Circle 9105 inside back cover.

Induced draft fan

Describing advantages and illustrating many features, 16-page bulletin covers complete line of induced draft fans.

An aid to engineers and specification writers, fully-dimensioned drawings and charts of ratings and specifications are presented.

(Bulletin L-3 is available from Lehigh Fan & Blower Division, Fuller Company, Dept. P&PSE, Catasauqua, Pennsylvania.)
Circle 9106 inside back cover.

You can rent analyzer to study power problem

Rental of a giant electrical network analyzer for power-system studies on a time basis is described in eight-page bulletin.

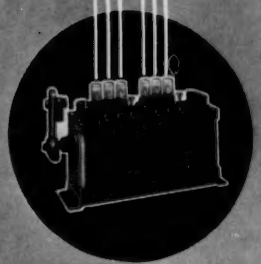
Providing an electrical miniature of almost any power system in the country, analyzer gives management and planning engineers of large industrials, utilities and consulting firms a fast, exact and economical means of charting growths and determining effects of changes.

(Network analyzer bulletin is available from I-T-E Circuit Breaker Company, Dept. P&PSE, 1900 Hamilton St., Philadelphia 30, Pa.)
Circle 9107 inside back cover.

dependable
accurate
lubrication

Put more **sense** in your lubrication **dollars**—with a Manzel Force Feed Lubricator. Outstanding Vacuum Pumping Units cut maintenance cost, increase accuracy, solve liquid sight feed problems. See your Manzel field engineer.

MANZEL



FREE CATALOG gives complete data on all Manzel lubricators.

Manzel

320 Babcock Street
Buffalo 10, N. Y.

Specialists in metering pumps and lubricators since 1898

Circle 9108 inside back cover.

IS YOUR THERMOCOUPLE LITERATURE FILE INCOMPLETE ?

A new bulletin on thermocouples is being offered. You'll find a review of this bulletin in the NEW LITERATURE section, starting on page 38. This bulletin is just one of some 72 selected pieces of plant and power services literature reviewed in this issue.

CUT HERE AND FILE

flow measurements with weirs

J. BRONSON BAYLISS
Asheville, N.C.

Part 2 – Triangular Weirs

The V-notch or triangular weir is slightly more complicated than the rectangular weir, but it provides considerably more flexibility. In general, the rectangular weir is suitable for measurement of large flows, but the V-notch is preferable for small flows or where a large range in head is desired.

Flow of water through a sharp-edged V-notch weir can be described by the empirical equation[1]:

$$q = 2.505(\tan\alpha/2)^{0.996}H^{2.47}$$

where

q = rate of flow, cu ft/sec
α = vertical angle of notch, degrees
H = head of water above vertex of notch, ft

Figure 2 has a folded scale for head and flow to provide range of flow from 3 to 3000 gpm. Rate of flow on high or low range scale is read by aligning proper V-notch angle with corresponding range on head scale.

LITERATURE CITED

1) PERRY, J.H., "Chemical Engineers' Handbook" p 408, 3rd ed, McGraw-Hill Book Co., Inc., New York (1950).

Fig 2

Nomograph for flow measurements with rectangular weir is on page 41

Distribution transformers —lighter, more compact

Complete technical specifications, essential design and operating data on dry-type distribution transformers are discussed in 28-page catalog.

Units are of a dry-type design said to be lighter in gross weight, more compact in over-all dimensions, and having extremely low noise levels.

The data covers dry-types, both single and three phase, to 500 kva, to standard ratings and voltages.

(Catalog #500 is issued by the Hill Transformer Co., Inc., 1030 Washington St., San Carlos, Calif.)
Circle 9109 inside back cover.

Airline conveying systems

Both high density and low density conveying systems for dry materials are described in 12-page bulletin.

Feeders and motivators for high density systems are shown. Typical arrangements for both high and low density systems are illustrated with schematic drawings. Accessory equipment is also described.

(Bulletin M-588 is issued by The Day Sales Company, Dept. P&PSE, 810 Third Ave. N.E., Minneapolis 13, Minn.)
Circle 9110 inside back cover.

Flexible shafting uses described

Bulletin explains briefly the advantages and simplicity of designing a flexible shaft into products having an application which requires control from remote places.

Also included are specification charts on both remote control and power drive cables plus complete data charts.

A brief explanation of uses of adapters for flexible shafting is given.

(Flexible shafting bulletin is issued by F. W. Stewart Corporation, 4311-13 Ravenswood Avenue, Chicago 13, Illinois.)
Circle 9111 inside back cover.

Instantaneous heater has large steam inlet

Instantaneous heaters with exclusive, extra-large steam inlet areas, are subject of 24-page bulletin.

Principal features described include; unique location of steam inlet, beyond the tube bundle to prolong tube life; rugged steel shell construction; compact, simplified design; seamless, copper alloy U-tubes and removable, pull-through tube bundles.

Selection tables, charts, and piping diagrams are provided.

(Bulletin 304.4K1 is issued by American-Standard, Industrial Division, Detroit 32, Michigan.)
Circle 9112 inside back cover.

Safety grating data given

Illustrations, complete engineering data for erection, plus accurate load charts for two types of gratings are presented in fully illustrated, 24-page catalog.

The two types of grating discussed include: one-piece construction in steel, aluminum and stainless steel; and welded grating which is projection-welded for high rigidity and strength.

(Catalog #5911 is issued by Products Division of The Globe Company, Dept. P&PSE 4000 South Princeton Ave., Chicago 9, Ill.)
Circle 9113 inside back cover.

Talks about insulation for rewound motors

Discussing an insulation for rewound motors, eight-page booklet lists industry and application for which the solventless epoxy encapsulation is best suited, and outlines its physical and chemical properties.

(Booklet B-7622 is issued by Westinghouse Electric Corp., Dept. P&PSE, PO Box 2099, Pittsburgh 30, Pa.)
Circle 9114 inside back cover.

Tells insulation use in low-temperature jobs

Many illustrations tell how to use Styrofoam insulation for low-temperature pipe and vessel covering applications.

The 12-page brochure presents a variety of engineering data, recommended application techniques and charts on recommended thicknesses and heat gain.

(Bulletin No. 157-57 is issued by The Dow Chemical Company, Plastics Sales, Dept. P&PSE, Midland, Mich.)
Circle 9115 inside back cover.

Hydraulic, pneumatic cylinders

A new 16-page report includes standard and special hydraulic and pneumatic cylinders and other related products.

It describes a different concept in hydraulic valve panel fabrication by building block components.

Other related products include boosters, air-oil tanks, and cylinders, oil tank level gages and flash welder control valves.

(Bulletin PSC-59 is available from the Petch Manufacturing Company, 463 York, Detroit 2, Mich.)
Circle 9116 inside back cover.

Discusses horizontal rotary burners

Information on horizontal rotary burners are given in three bulletins. Various models are described and cutaway drawings are included.

Fully automatic, model B uses unheated #5, #2, and #4 oils. It has a viscosity up to 258 S.S.U. at 100°F.

Model BHE is also fully automatic and uses all grades of #6 oil. It has precision metering and a roto-spray.

(Bulletins 405, 415 and 420 are issued by Preferred Utilities Manufacturing Corporation, 41 East 42nd St., New York 17, N. Y.)
Circle 9117 inside back cover.

Motor-speed reducer package for any job

Complete line of all-steel, helical gear, all-motor and integral motor-speed reducer packages is described and illustrated in 28-page revised bulletin.

Revision includes change in selections, dimensions and weights to incorporate rerated NEMA standard motors from 1 through 75 hp, and increased overhung load and thrust capacities for first three sizes.

Topics include detailed information on unit size and construction, how to select proper size and ratio, typical installations, data on accessories, and suggestions for use in unusual or special applications.

(Bulletin 3100 is isued by The Falk Corporation, Dept. P&PSE, Box 492, Milwaukee 1, Wis.)
Circle 9118 inside back cover.

For more information on items reported in the New Literature section circle corresponding numbers on reader service card opposite back cover.

Heat exchangers and heating equipment

Four-page brochure describes heat exchangers and heaters with integral fintubes. Products included are hairpin heat exchangers, tank heaters, fired indirect heaters, process heaters and coolers, and packaged boilers.

Heat transfer tubes used in this equipment consist of tubing to which longitudinal U-shaped channels have been resistance welded. Tubes provide a highly efficient heat transfer surface, extending the area per linear foot of tubing up to 800 percent.

(Bulletin 581 is issued by the Brown Fintube Company, Dept. P&PSE, 508 Huron St., Elyria, Ohio.)
Circle 9119 inside back cover.

Single-Point pH Recorder (Strip Chart Assemblies also available)

CAMBRIDGE pH INDICATORS and RECORDERS

Labor saving—profit producing!

In addition to portable pH meters, Cambridge makes line-operated Direct Reading pH Indicators and Recorders for permanent installation. They are accurate, stable and assure continuous and trouble-free performance. Either the Recorder, Indicator or both, may be located at any reasonable distance from one or several sampling points. The Glass Electrodes are placed in vapor-tight housings of clog-free sampling chambers.

Send for Bulletin No. 910 T

CAMBRIDGE pH EQUIPMENT

CAMBRIDGE INSTRUMENT CO., INC.

3550 Grand Central Terminal, New York 17

PIONEER MANUFACTURERS OF PRECISION INSTRUMENTS

Circle 9120 inside back cover.

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BY HAVING A NOMOGRAPH IN

Plant and Power Services Engineer

PLANT and POWER SERVICES ENGINEER is looking for good nomographs designed to simplify calculations necessary to efficient plant and power services. If you have such a nomograph that has been helpful to you in your work — and it has not been published before — send it to:

Data Editor
PLANT and POWER SERVICES ENGINEER
111 E. Delaware Place
Chicago 11, Illinois

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Plant-Power Services Engineer

nomograph 26

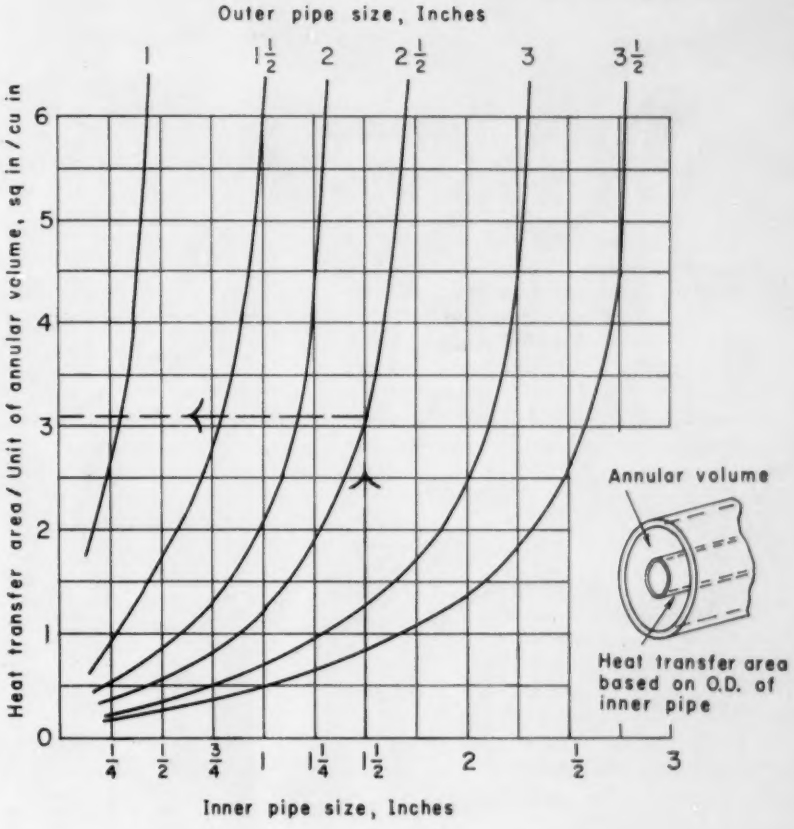
Heat transfer area for an annulus

DENNIS E. DRAYER
Dow Chemical Co.
Midland, Mich.

Accompanying plot has evolved from a study of heat transfer data obtained from double-pipe reactors. Basically, it correlates heat transfer areas per unit of annular volume for various combinations of pipe sizes.

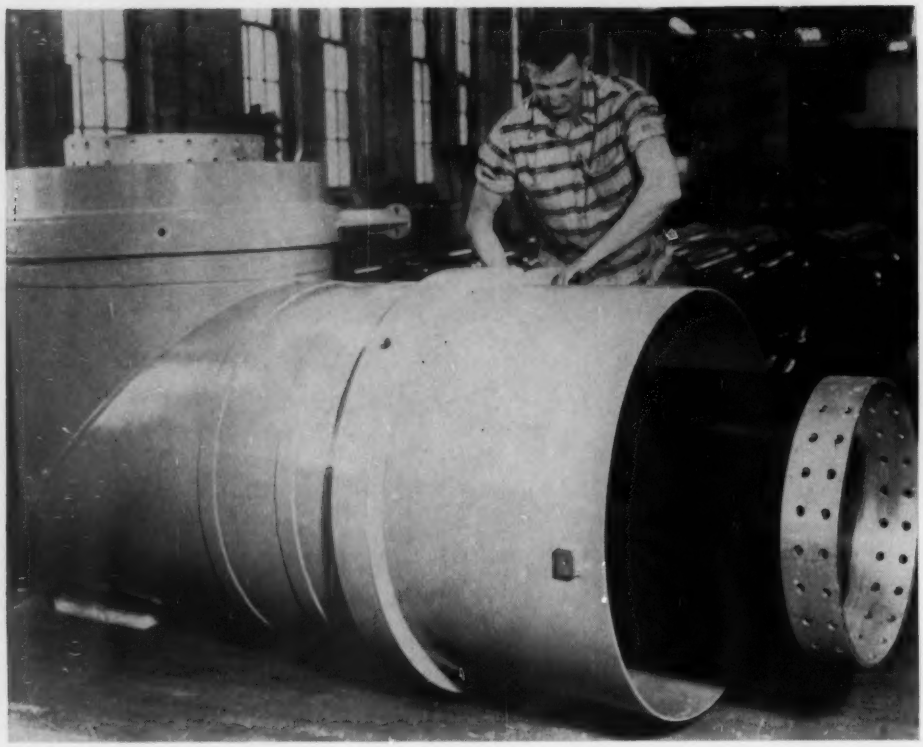
Plot proves extremely useful in scale-up work that involves heat exchangers and tubular reactors.

Arrows show that a heat exchanger consisting of a 1½-inch standard pipe in a 2½-inch standard pipe supplies 3.1 square inches of heat transfer area (based on outer diameter of inner pipe) per cubic inch of annular volume.



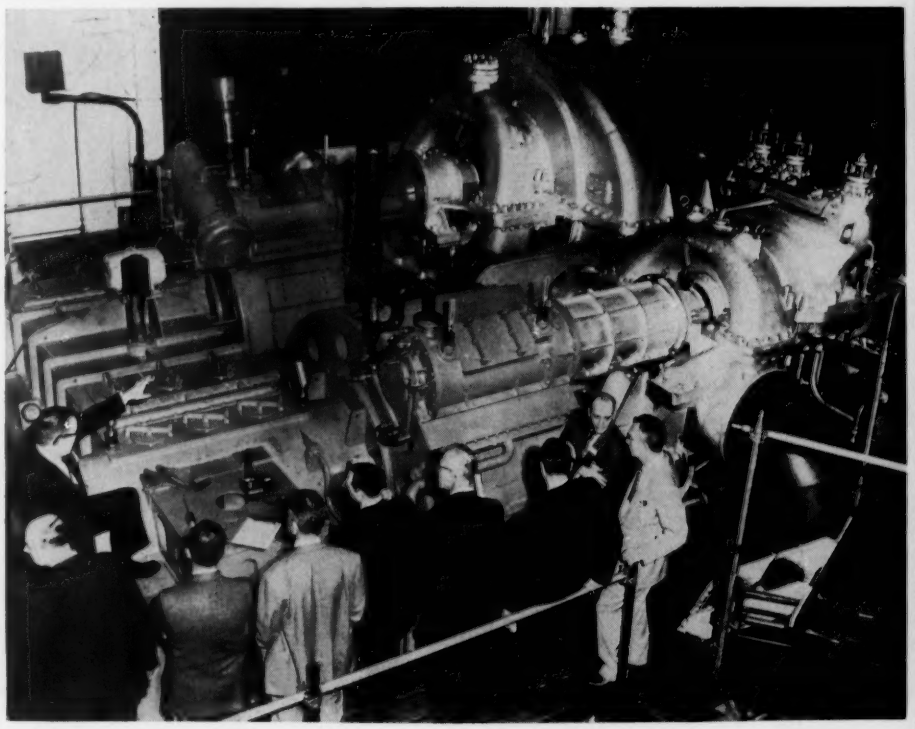
Note:
Pipe sizes are nominal.
Heat transfer area based on O.D. of inner pipe.

PHOTO NEWS

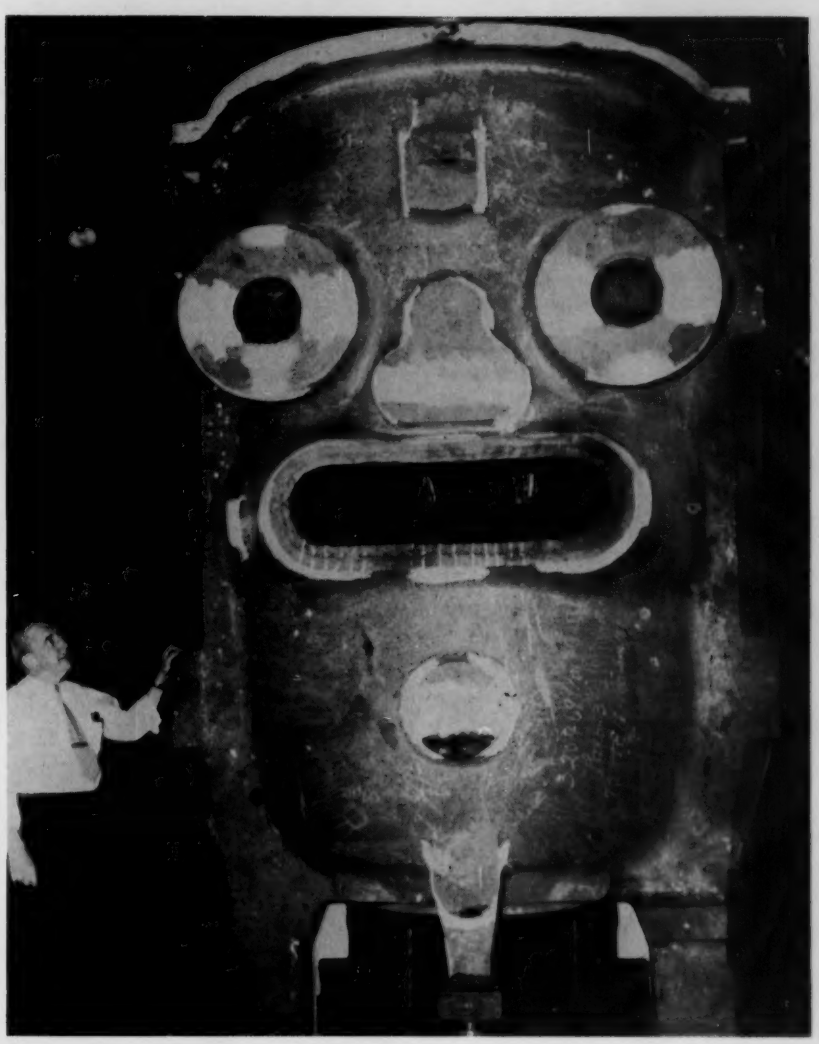


WILL CARRY 12,000 AMPS — Section of isolated phase bus slated to carry 12,000 amps — the highest current-capacity bus ever produced — receives final inspection at I-T-E Circuit Breaker Co. Some 320 ft of the bus — a 20½-inch round aluminum conductor in a 35-inch non-magnetic aluminum housing — will be used as a station generator-to-transformer connection.

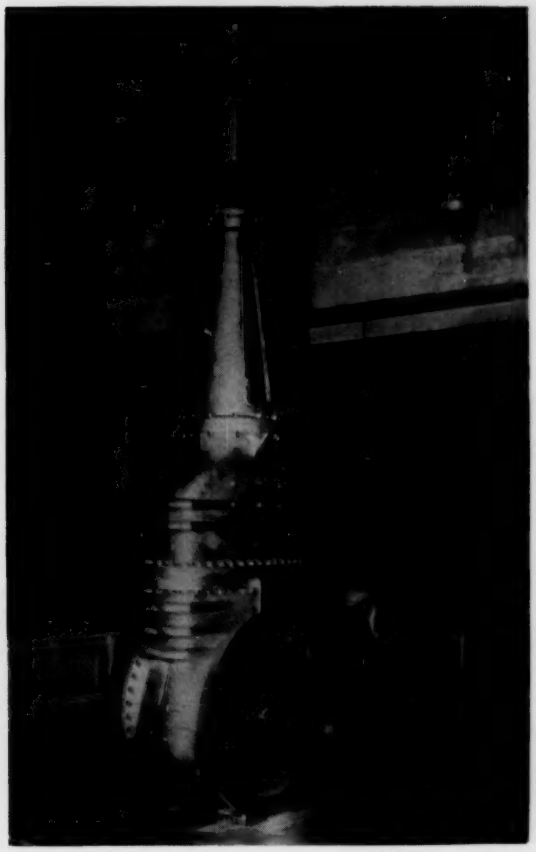
ON THE MOVE — This 300-ton atomic power reactor for Commonwealth Edison's Dresden Nuclear Power Station is shown just before it was moved into the 190-ft steel sphere. The reactor vessel is 42 ft high and 12 ft in diameter. Its walls are 5½ inches thick.



FOR THE NUCLEAR SHIP SAVANNAH — Main propulsion machinery for the first atomic surface vessel is viewed by AEC, Maritime Administration and newsmen during initial shop tests at De Laval Steam Turbine Co. Machinery is capable of delivering 22,000 shaft hp and weighs approximately 350,000 lb.



▲ BOO! Although it looks like something belonging to a witch doctor, this 18-ft high, 30,000-lb steel "mask" is, in reality, a portion of a General Electric steam turbine high-pressure shell — part of an 82,500 kw unit destined for Puerto Rico. The warrior-like markings on the "face" are areas which have been marked to facilitate laying out locations for subsequent machining and drilling operations.



◀ STANDING 217 INCHES HIGH and weighing slightly more than ten tons, this is one of the largest steel valves ever manufactured by Crane Co. Produced for a Midwest refinery, the 48-inch gate valve is used as a positive shut-off on 1000°F hydrocarbons.

Automatically analyzes for trace substances

Eight-page bulletin describes industrial instruments available for colorimetric determinations of trace quantities of substances dissolved in liquid process streams.

Bulletin specifically gives details on anaylzers for dissolved silica, dissolved oxygen and total water hardness.

Schematic diagrams are included as well as descriptions of the pneumatic programmer, unique sample cells and devices for measuring reagent. Analyzers are also available for hydrazine, residual chlorine, total iron, phosphates, fluorides, cyanides, chromium, copper, formaldehyde, sulfites and sugar.

(Bulletin 1156-1 is issued by Milton Roy Company, Dept. P&PSE, 1300 E. Mermaid Lane, Philadelphia 18, Pennsylvania.)
Circle 9121 inside back cover.

All about moving and using air

Composite product bulletin describes complete line of products for air filtering, cooling, heating, cleaning, moving, exhausting, humidifying and dehumidifying air.

The 16-page bulletin covers such equipment as air conditioning units and coils, packaged liquid chillers, cooling towers, evaporative condensers, heating and ventilating units, steam and water coils, and other component parts.

(Bulletin No. 518 is issued by American Air Filter Co., Inc., Dept. P&PSE, 215 Central Ave., Louisville 8, Ky.)
Circle 9122 inside back cover.

Selenium rectifiers

Eight-page catalog presents basic characteristics of selenium rectifiers in great detail with temperature derating table as well as an overload and allowable-currents-under-various-forced-cooling curves.

One page is devoted exclusively to general design information on rectifier circuits.

A code designation chart, a DC voltage chart and bracket dimensions are also presented.

Shown for the first time is a practical method for computing overall length of a selenium rectifier stack.

(Selenium rectifier booklet is available from RECTICO, Inc., Dept. P&PSE, 963 Frelinghuysen Ave., Newark 12, New Jersey.)
Circle 9123 inside back cover.

AC tachometer generator

Reversible shaded-pole motor fulfills requirements of an AC tachometer or rate generator. With rated AC voltage applied to main winding, a voltage is generated in the shading windings which is proportional to speed at which the rotor is driven.

Voltage is nearly linear from 1000 to 3000 rpm.

Two-page data sheet gives all details and includes a performance characteristic chart.

(Data Sheet F 9256 is available from Barber-Colman Company, Dept. P&PSE, Rockford, Ill.)
Circle 9124 inside back cover.

When glass is broken switch is opened

Line of heavy-duty breakglass switches, rated 5 amps at 250v AC or 10 amps at 125v AC, is described in two-page publication.

Two forms of control switches are listed — a single-pole, double-throw switch is connected to cause the remote control switch to open when glass is broken. The other, suitable for two-wire operated devices, is a single-pole, single-throw switch. The glass holds this switch in closed contact position so that, when it is broken, switch contacts open.

Applications include emergency safety controls on oil burners, air conditioners and refrigeration equipment.

(Publication 655 is available from Automatic Switch Company, Dept. P&PSE, Florham Park, N.J.)
Circle 9125 inside back cover.

200 solenoid valves

Complete line of over 200 solenoid valves of bronze and stainless steel construction are listed and pictured in 36-page catalog.

Valves are available for use with pressures from 0 to 10,000 psi and temperatures from −300° to +500°F on air, steam, corrosive and non-corrosive gases and liquids systems.

All materials organized and presented in such manner as to be of maximum assistance to equipment and systems design engineer.

(Catalog 444 is available from Atkomatic Valve Co., Dept. P&PSE, 545 West Abbott St., Indianapolis, Ind.)
Circle 9126 inside back cover.

Helpful information on propeller fans

Giving details on complete line of self-cooled motor propeller fans, 20-page booklet covers fan capacities ranging from 250 to 40,500 cfm.

Included in the catalog is helpful information on how to select fan size needed, motor specifications, fan construction and dimensions, and accessory equipment.

Duct fans, wall ventilators, floor fans, cooling and circulating fans are also presented.

(Propeller fan catalog is issued by Ilg Electric Ventilating Co., Dept. P&PSE, 2850 N. Pulaski Rd., Chicago 41, Ill.)
Circle 9127 inside back cover.

"Knit one, purl two . . ."

Automatic analyzer is simple to use

For automatic determinations of water hardness, pH, residual chlorine, phosphate, hydrazine and dissolved iron concentration, colorimetric analyzer works by hydraulic displacement and requires no electric or pneumatic power.

Two-page bulletin describes operation, application and design specifications, plus a three-part illustration of the automatic steps in each analysis.

(Bulletin 858 is issued by Florida Instrument Company, a division of Milton Roy Co., Dept. P&PSE, 1300 E. Mermaid Lane, Philadelphia 18, Pa.)
Circle 9128 inside back cover.

Have corrosive locations? Here's conduit to use

Which material for conduits should be used for which corrosive atmosphere? This is the subject of a 16-page bulletin which presents numerous tables of corrosive substances together with the metals and alloys to be used in conduits for these locations.

The booklet also contains first formal listings of a plastic coated conduit for hazardous and non-hazardous locations.

(Bulletin 2699 is available from Crouse-Hinds Co., Dept. P&PSE, Syracuse 1, N. Y.)
Check 9129 opposite last page.

How to get a good fit

A simple-to-use check list of fastener ills and how to solve them are listed in pocket-sized folder.

With this check list in hand, an operator can solve a problem of a bolt loosening in a tap hole by pin-pointing the trouble through the use of various instruments.

(Checklist form 2422 is available from Standard Pressed Steel Co., Dept. P&PSE, Box 548, Jenkintown, Pennsylvania.)
Check 9130 opposite last page.

Shows 60 installations of dust, fume control

Sixty different plant installations from a wide variety of major industries are illustrated and described in 52-page catalog on dust and fume control systems.

To emphasize engineering the best system for each particular application, as many distinctly different types of control as is possible are featured. Large photographs show all design details.

(Dust & Fume Controls Catalog is issued by The Kirk & Blum Manufacturing Company, Dept. P&PSE, Cincinnati 9, Ohio.)
Check 9131 opposite last page.

Simple control valve for air, water, oil

Three- and four-way control valve, for use with water, air, hydraulic fluid, or oil as a pressure medium at operating pressures to 300 psi, is described in four-page bulletin.

Nine illustrations, including wash drawings of cut-away views and several diagrams, explain operating principle and design features.

The valve is available in three pattern sizes covering five standard pipe sizes from ¼ inch to 1 inch. It is small enough and light enough to be supported by connected piping.

(Bulletin 300 is issued by W. H. Nicholson and Company, Dept. P&PSE, 12 Oregon St., Wilkes-Barre, Pa.)
Circle 9132 inside back cover.

Flexible rubber pipe handles many jobs

For use wherever corrosion abrasion, vibration or thermal expansion would necessitate excessive replacement of conventional pipe, flexible rubber pipe is easy to install and eliminates fabricated bends, leaky joints, and costly rearrangement of existing facilities.

Brochure gives full story.

(Bulletin 7152 is issued by Raybestos-Manhattan, Inc., Manhattan Rubber Division, Dept. P&PSE, Passaic, N. J.)
Circle 9133 inside back cover.

Automatic power plant

Engineering bulletin discusses application of electronic controls for power generation.

12-page bulletin describes application of newly developed automatic controls for sensing power loads, starting, regulating and shutting down engine-generating units to meet varying line demands.

(Bulletin No. E-88 is available from The Cooper-Bessemer Corporation, Dept. P&PSE, Mount Vernon, Ohio.)
Circle 9134 inside back cover.

Shows package deaerators

Package deaerators, for small and medium sized boiler plants, is subject of four-page booklet describing a complete line with accessories for immediate shipment.

Units are designed to provide, in a matter of days, highly efficient deaeration for both new installations and existing boiler plants.

(Bulletin #4528 is issued by The Permutit Co., a div. of Pfaudler Permutit Inc., Dept. P&PSE, 50 W. 44th St., New York 36, N.Y.)
Circle 9135 inside back cover.

Tells when you exceed differential pressure

Description of method of operation, dimensions, materials of construction, and optional features of a differential pressure indicator is covered in two-page bulletin.

The small device weighing 0.27 lbs, for use in −65°F to +275°F systems up to 5000 psi indicates by a pop-up red button when the differential pressure exceeds a stated value — normally in the 5 to 100 psi range.

(Bulletin A-109 is available from Aircraft Porous Media, Inc., Dept. P&PSE, 30 Sea Cliff Ave., Glen Cove, N. Y.)
Circle 9136 inside back cover.

How to remove sludge from fuel, lube oil

Eight-page bulletin explains how continuous centrifuges can purify fuel and lubricating oils. Detailed cross sections with shading in colors show details of flow of feed, sludge and purified streams in this type of equipment.

Table shows capacity of each of five models for desludging various materials. Typical hook-ups are illustrated.

(Bulletin No. 2177 is issued by Centrico, Inc., Dept. P&PSE, 75 West Forest Ave., Englewood, N.J.)
Circle 9137 inside back cover.

Water Problems

From page 14

pentachlorophenate, quaternary ammonium compounds, rosin amines and other materials. They must be fed in controlled amounts. Underfeeding will not accomplish the desired control action, and overfeeding can result in harmful side effects such as corrosion acceleration, wood deterioration, and foaming.

4) Destruction of wood. Wood is composed of cellulose fibers held together by a binding material, lignin, and is subject to several forms of attack that can lower the efficiency of a cooling tower. First of all, delignification and cellulose removal can occur. Lignin is soluble in alkaline solution and can be leached out of wood by an alkaline circulating water.

Delignification is minimized by maintaining the pH of the circulating water in the range 6.5 to 7.5. In many cases, this requires the use of an acid. Sulfuric acid is generally used because of its low cost, but other materials such as hydrochloric acid and sodium bisulfate can be used.

One investigator reports that wood destroying organisms were always present in wood that supposedly suffered from delignification. No attack resulted when preservatives were present. This indicates that the attack was microbiological rather than chemical.

To next page

"Eenie, meeny, miney, mo. . . ."

Water Problems

From preceding page

Secondly, fungus organisms feed on wood causing it to rot. These organisms thrive in the presence of oxygen and moisture. Some feed on wood cellulose, others on lignin. The resulting attack is hard to distinguish by visual examination from that due to alkaline-water delignification.

No completely satisfactory method for preventing fungus attack has yet been worked out. Pretreatment of cooling tower lumber with copper compounds, phenolic materials and other fungicides does some good. Weed killers applied to already operating towers will destroy fungus organisms.

The erosion of wood by flowing or falling water is intensified by suspended solids in the water. This can be minimized by improvement in design and by reducing the concentration of suspended solids either by blowdown or by installation of a side stream filter. ■

Sea Water Conversion

From page 21

mately have a process that is 20 percent efficient, we would need about 14 kilowatt hours per thousand gallons for separation only. At seven mills per kilowatt hour, this would be about $30 per acre foot.

Then, as to the process itself, let us further assume that it would be as simple and economical as pumping out of Lake Michigan and filtering, or an additional $70 per acre foot. Totaling the above, we have a cost of $170 per acre foot, or about 50 cents per thousand gallons, which would seem to be about the minimum for a confined process.

For costs lower than this, it would seem that the process must ultimately be one where some "free" natural energy and facilities can be largely employed. Cloud seeding would be one such process. Another might be in the biological field, the separation being accomplished by plant or animal life. ■

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THAT'S INTERESTING

Not a whisper of a roar — well, hardly

Jet airliner passengers will hardly be aware of the roar of the powerful engines thanks to a new type of a vinyl plastic coated fabric designed to absorb low-frequency engine sounds.

Called Coustifab, it consists of either cotton or fiberglass fabric specially treated with a vinyl plastisol containing powdered lead. The result is an exceptionally flexible fabric with sufficient mass to absorb the low frequency sounds which normal acoustical material cannot handle.

Engineers at Mobile Plastics Division of the Cordo Chemical Corp., developed the material based on Geon polyvinyl resins supplied by the B. F. Goodrich Chemical Co.

Weather — still champ

Salt water, humidity, fumes, chemicals — they're all named in a recent Rust-Oleum survey of 4000 chief engineers — but Old Man Weather still reigns supreme as the prime offender in rust-producing conditions deemed most serious by the chief engineers.

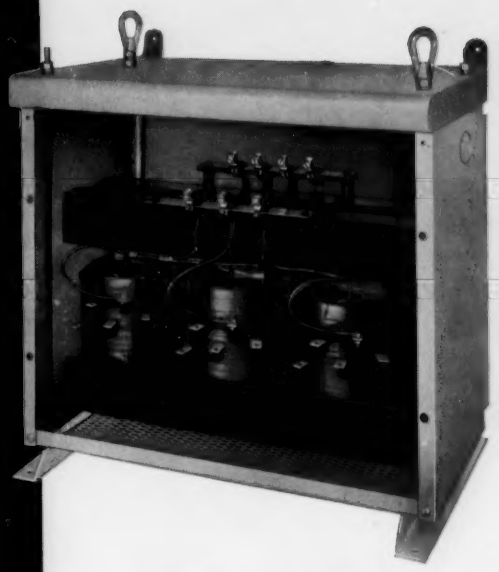
Aids atomic subs

The old and new still work together. Everyone knows the newest submarines are propelled by nuclear reactors. Not so well known is the fact that each also carries large, multi-cell storage batteries as a source of auxiliary power.

These would provide necessary power to restart the reactor in case of emergency or forced shutdown. It also provides power for the intricate control system which keeps reactor operating safely.

These batteries are manufactured by the Exide Industrial Division of the Electric Storage Battery Co.

it's an inside job!



45 Kva 3-phase transformer with taps. Interchangeable wall or floor mounting. Front panel removed, showing interior.

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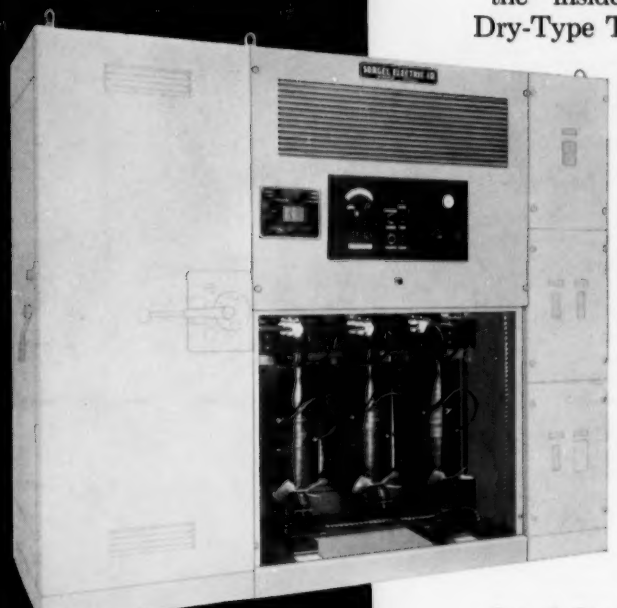

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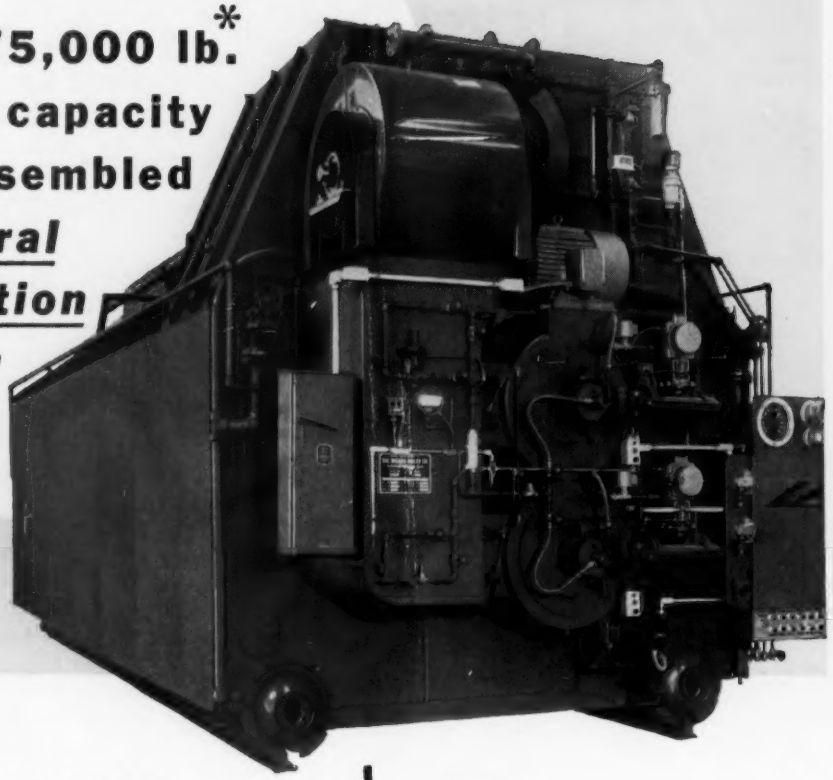

*75,000 lbs. per hour present capacity.
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